

**SALTVILLE STORAGE PROJECT**

**EPA REGION III**

**AF AREA PERMIT APPLICATION**

**INTRODUCTION**

**SALTVILLE STORAGE PROJECT**

**EPA REGION III  
AREA PERMIT APPLICATION**

## **INTRODUCTION**

### **SALTVILLE STORAGE PROJECT**

Virginia Gas Company ("VGC") submits this application for an Environmental Protection Agency Area Permit to drill and to operate up to three Class I-I Nonhazardous Industrial Disposal wells and up to three Class III-G Solution Mining wells for use in its proposed underground gas storage facility at Saltville, Virginia.

VGC, in partnership with Tenneco Energy Resources Corporation, is developing a high deliverability underground gas storage facility on Town of Saltville property, approximately one mile southwest of downtown Saltville. VGC is operator and project manager and is applying for this permit on behalf of the partnership.

Construction began in March, 1995. As part of Phase I, an existing cavern in wells C.H. 16 & C.H. 20 that was originally created during salt mining is being re-entered and converted to use for gas storage for peak day requirements of customers connected to Tenneco Gas' East Tennessee Natural Gas ("ETNG") system. This cavern is currently filled with over one million barrels of saturated salt water brine.

Other facilities that will be built as part of Phase I are:

1. A four mile pipeline to connect the facility to ETNG's line number

3300 near their Glade Spring compressor station;

2. A compressor station in Saltville for injection of gas into the cavern;

3. Two surface holding ponds, and;

4. An exploratory gas well that may be converted into a Class I-I salt water disposal well if it does not produce gas in commercial quantities.

The Saltville Partners plan to develop up to 50,000 Dth per day of deliverability and 655,000 Dth of working gas capacity in the existing cavern in Phase I, and to offer ten and thirty day services available beginning November 1, 1996. In Phase II, 375,000 Dth of additional capacity will be created by leaching new caverns using the solution mining method in three new Class III-G wells as customers request additional service. Two additional Class I-I salt water disposal wells may also be drilled in Phase II. No fresh water will be required in Phase I. Phase II will require between 2,100,000 and 3,000,000 barrels of water for creation of each of the three proposed caverns.

Along with EPA regulation, this project will also be regulated by the State Corporation Commission of Virginia ("SCC"). Approval of the project by the SCC involves review by the following state agencies:

Department of Agriculture & Consumer Services  
Department of Conservation & Recreation  
Department of Environmental Quality  
Department of Forestry  
Department of Game & Inland Fisheries  
Department of Health

Department of Historic Resources  
Department of Mines, Minerals, & Energy  
Department of Transportation  
Virginia Marine Resources Commission  
Smyth and Washington County Governments  
Mount Rogers Planning District Commission

# SALTVILLE GAS STORAGE PROJECT

## PHASE I STATISTICAL DATA

25 APRIL 1995

<u>Maximum Withdrawal Rate:</u>	1996/97	25,000 Dth/day
	1997/98	50,000 Dth/day

Assumes 85% of capacity of 655,000 Dth subscribed as 10 day service and 15% of capacity subscribed as 30 day service.

### Total Cavern Capacity:

Well C.H. 16	1.6 million barrels
Well C.H. 20	<u>1.2 million barrels</u>
TOTAL	2.8 million barrels

If 1.0 million barrels of this space is dewatered, the gas storage capacity of the cavern will be:

Working Gas	655,000 Dth
Base Gas	<u>278,000 Dth</u>
TOTAL	933,000 Dth

### Operating Pressures:

Maximum	2,300 PSIA
Minimum	720 PSIA

### Operating Temperatures:

Maximum	120 degrees F
Minimum	100 degrees F

### Total Area of Project:

750 acres

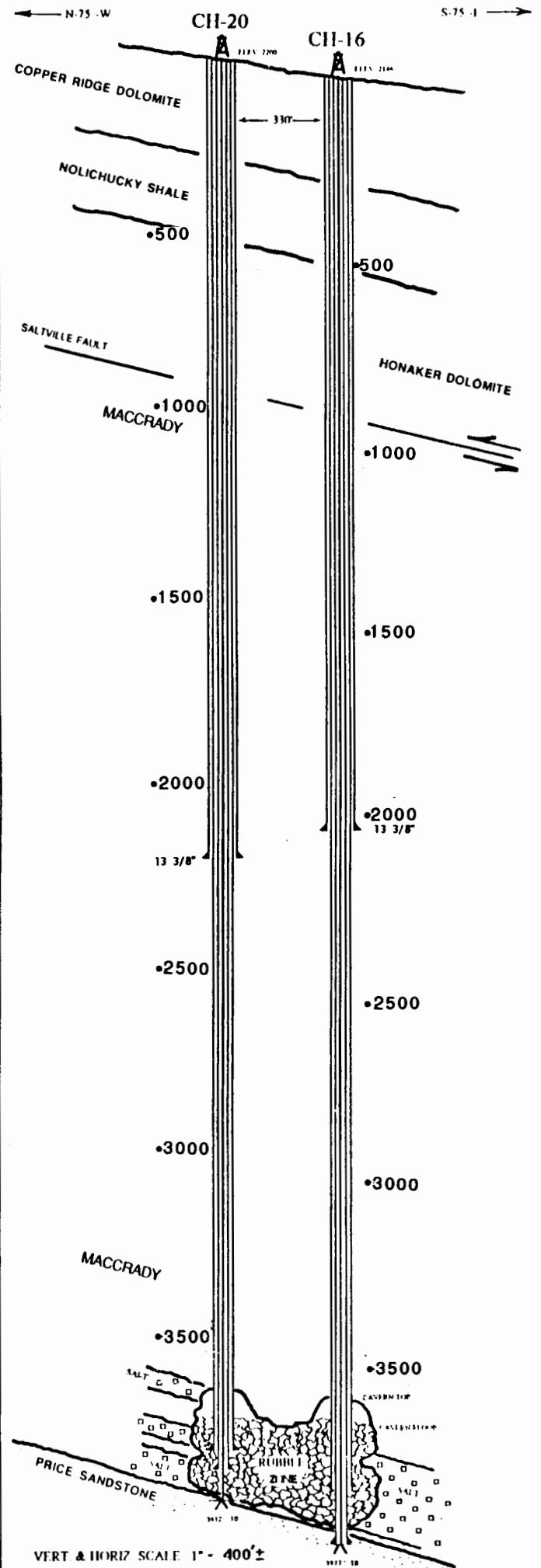
### Compression:

720 BHP for 50 day refill  
2100 BHP for 20 day refill

### Pipelines:

29,300 feet of 8-inch  
Saltville Storage Facility to ETNG Station 3311

SCHEMATIC CROSS-SECTION  
EXISTING CAVERN (WELLS CH-16 & CH-20)



## 1995-96 ACTIVITY SCHEDULE

## 1995-96 ACTIVITY SCHEDULE

No.	ITEM	Apr-95	May-95	Jun-95	Jul-95	Aug-95	Sep-95	Oct-95	Nov-95	Dec-95	Jan-96	Feb-96	Mar-96	Apr-96	May-96	Jun-96	Jul-96	Aug-96	Sep-96	Oct-96	Nov-96	Dec-96
1	EPA Permit	1																				
2	DEQ Permit	2																				
3	SHPO Permit	3																				
4	Certificate Preparation	4																				
5	Exploration Phase	5																				
6	Consumer Commitment																					
6a	Expression of Interest	6a																				
6b	Precedent Agreement	6b																				
6c	Contracts	6c																				
7	Operation Certificate	7																				
8	Development Phase 1																					
8a	Disposal Well (Gas)	8a																				
8b	Holding Pond	8b																				
8c	Debrine Cavern	8c																				
8d	Install Pipeline	8d																				
8e	Install Compression	8e																				
9	Initial Injection	9																				
10	Initial Withdrawal	10																				
11	ETNG Improvements	11																				

**HISTORY OF INDUSTRIAL ACTIVITY  
RELATING TO  
SALTVILLE STORAGE PROJECT**

- 1790 First salt well dug in area.
- 1799 William King digs shaft 10 feet square and 200 feet deep for commercial production of salt brine. Salt shipped to customers in Tennessee Valley by small barges down North Fork of Holston to "King's Port" in Tennessee.
- 1815 Gypsum or "plaster" mining begins near Plasterco.
- 1843 Six salt wells between 200 and 386 feet deep are in operation. Salt works operated using slave labor and firewood as energy.
- 1861 Major source of salt for Confederate States of America -- only domestic source after Union Army capture of Avery Island, Louisiana.
- 1864 Salt works destroyed by Union Army raid. Black union prisoners massacred after battle.
- 1892 Mathieson Alkali Works chartered. Production of sodium bicarbonate, chlorine bleach and caustic soda begins in 1895. All prior production table salt.
- 1907 Approximately 24 wells up to 2380 feet deep are in production in the low pressure brine field; eventually, another 175 wells are drilled in low pressure field in the next 65 years.
- 1918 U.S. Government builds a \$2 million plant near Saltville for the production of sodium cyanide used in munitions in World War I.
- 1930 First wells drilled in high pressure brine field in hills south of low pressure field. By 1971 a total of 30 wells are drilled in high pressure field, including C.H. 16 and C.H. 20.
- 1954 Mathieson merges with Olin Industries.
- 1957 Drilling commences 1/5/57 using cable tools on well C.H. 16. Well reaches a total depth of 3977 feet on 1/10/59. Salt production by the solution mining method continues until 1972.

- 1959 Drilling begins on 10/28/59 on well C.H. 20. Well reaches total depth of 3912 feet on 11/24/62. Interconnected with C.H. 16 cavern on 2/5/71.
- 1972 Olin Mathieson ceases all brine production following labor problems in late 1960s and passage of National Environmental Policy Act. Wells C.H. 16 & C.H. 20 plugged by Fenix & Scisson in December, 1972.
- 1978 MAPCO re-enters C.H. 16 & 20 wells to evaluate for propane storage. Replugged wells in 1982 after concluding that caverns were too small for their requirements.
- 1993 Virginia Gas Company leases 11,000 acres from Saltville Industrial Development Authority for underground gas storage project. Geological and engineering studies begin.
- 1994 Tenneco Energy Resources Corporation joins project as a 50% owner. Virginia Gas designated operator and project manager. Phase I environmental assessment indicates that past and present uses of property have not caused significant environmental degradation to the project area.
- 1995 Site construction begins for conversion of existing cavern underlying wells C.H. 16 & 20 to gas storage.

**FORM 4**

**PERMIT APPLICATION**

Form <b>4</b> UIC	<b>EPA</b>	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY <b>UNDERGROUND INJECTION CONTROL PERMIT APPLICATION</b> (Collected under the authority of the Safe Drinking Water Act, Sections 1421, 1422, 40 CFR 144)	I. EPA ID NUMBER  T/A  U
-------------------------	------------	--	--------------------------------------

READ ATTACHED INSTRUCTIONS BEFORE STARTING  
FOR OFFICIAL USE ONLY

Application approved mo day year	Date Received mo day year	Permit/Well Number	Comments

II. FACILITY NAME AND ADDRESS		III. OWNER/OPERATOR AND ADDRESS	
Facility Name Saltville Storage Project		Owner/Operator Name Virginia Gas Company	
Street Address Washington-Smyth Counties		Street Address 120 South Court St. (P.O. Box 2407)	
City Saltville	State VA	ZIP Code 24370	City Abingdon
			State VA
			ZIP Code 24210

IV. OWNERSHIP STATUS (Mark 'x')		V. SIC CODES	
<input type="checkbox"/> A. Federal	<input type="checkbox"/> B. State	<input checked="" type="checkbox"/> C. Private	
<input type="checkbox"/> D. Public	<input type="checkbox"/> E. Other (Explain)		
		4922	1474

VI. WELL STATUS (Mark 'x')	
<input type="checkbox"/> A. Operating	<input type="checkbox"/> B. Modification/Conversion
Date Started mo day year	<input checked="" type="checkbox"/> C. Proposed

VII. TYPE OF PERMIT REQUESTED (Mark 'x' and specify if required)			
<input type="checkbox"/> A. Individual	<input checked="" type="checkbox"/> B. Area	Number of Exist- ing wells 0	Number of Pro- posed wells 6
		Name(s) of field(s) or project(s) Saltville Storage	

VIII. CLASS AND TYPE OF WELL (see reverse)			
A. Class(es) (enter code(s))	B. Type(s) (enter code(s))	C. If class is "other" or type is code "x," explain	D. Number of wells per type (if area permit)
I, III	I, G		3

IX. LOCATION OF WELL(S) OR APPROXIMATE CENTER OF FIELD OR PROJECT										X. INDIAN LANDS (Mark 'x')			
A. Latitude		B. Longitude		Township and Range								<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Deg	Min	Sec	Deg	Min	Sec	Twsp	Range	Sec	1/4 Sec	Feet from	Line	Feet from	Line
36	52	00	81	46	00								

XI. ATTACHMENTS
-----------------

(Complete the following questions on a separate sheet(s) and number accordingly; see instructions)

FOR CLASSES I, II, III (and other classes) complete and submit on separate sheet(s) Attachments A — U (pp 2-6) as appropriate. Attach maps where required. List attachments by letter which are applicable and are included with your application: A, B, C, D, F, H, I, J, K, L, M, N, O, P, Q, R, T, U

XII. CERTIFICATION
--------------------

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

A. Name and Title (Type or Print)	B. Phone No. (Area Code and No.)
C. Signature	D. Date Signed

**FORM 4**  
**ATTACHMENT A**  
**AREA OF REVIEW**

## **FORM 4**

### **ATTACHMENT A**

#### **AREA OF REVIEW METHODS**

Virginia Gas Company is applying for an area permit. The area of review was determined to be a radius of 1526' circumscribing the project area. Mapping will be extended to a fixed radius of 1 mile as specified in the UIC permit application instructions for Attachment B.

There are no wells in the project area that penetrate the formations in which VGC proposes to inject salt water brine. Since no data is available on the deep formations, the radius of the area of review was determined using the following assumptions:

- \* The proposed stratigraphic section for disposal encompasses a thickness of approximately 4643' from top of the Price clastics to the top of the Sequatchie shales.
- \* Only 10% of this section proves to be injectable for a total thickness of 464'.
- \* Effective porosity for this interval is only 1% (2% porosity discounted for a 50% water saturation). This is a conservative figure as actual porosities of sandstone reservoir rocks in the Appalachian Basin average between 5-10% and this

stratigraphic interval will contain several hundred feet of sands and silts.

\* Net feet of vertical void = 4.6 (1% of 464')

One acre (43,560 sq. ft.) possesses 200,376 ft<sup>3</sup> of effective void.

Approximately 6,000,000 bbls. of brine could then be contained within a 168 acre confine (radius of 1526').

Calculations:

168 acres = 7,318,080 sq. ft.

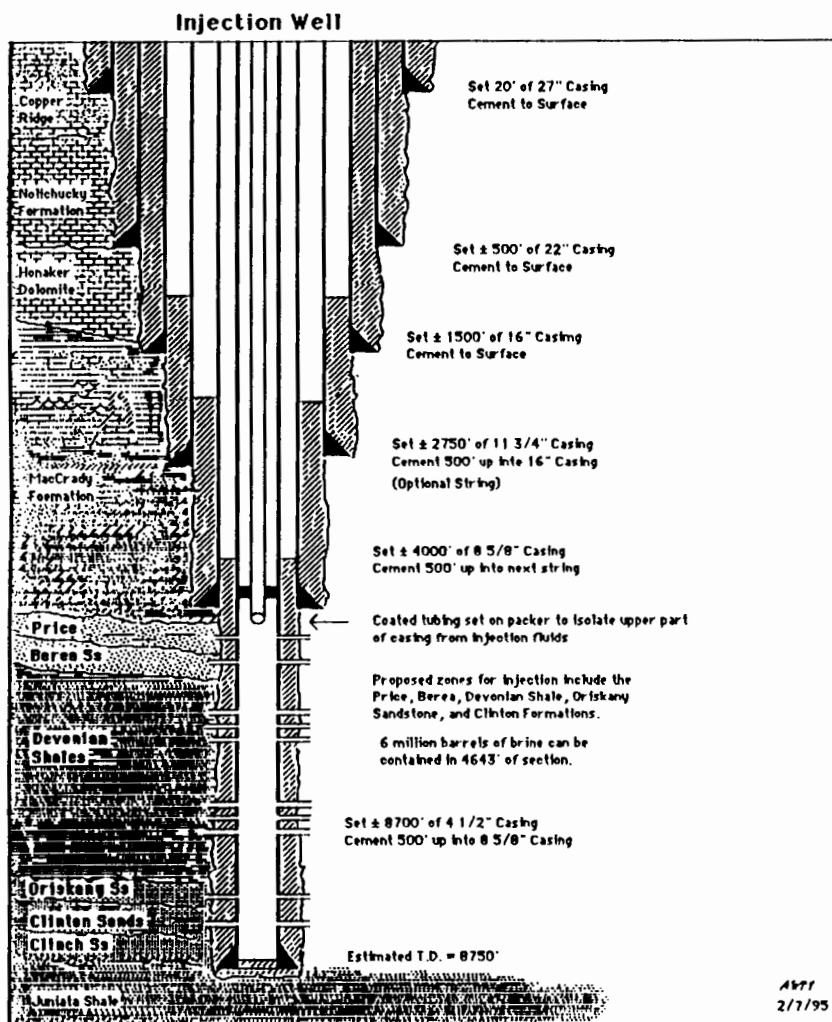
7,318,080 sq. ft. \* 4.6 ft. of void = 33,663,168 ft<sup>3</sup>

33,663,168 ft<sup>3</sup> \* .1781 bbls/ft<sup>3</sup> = 5,995,410 bbls.

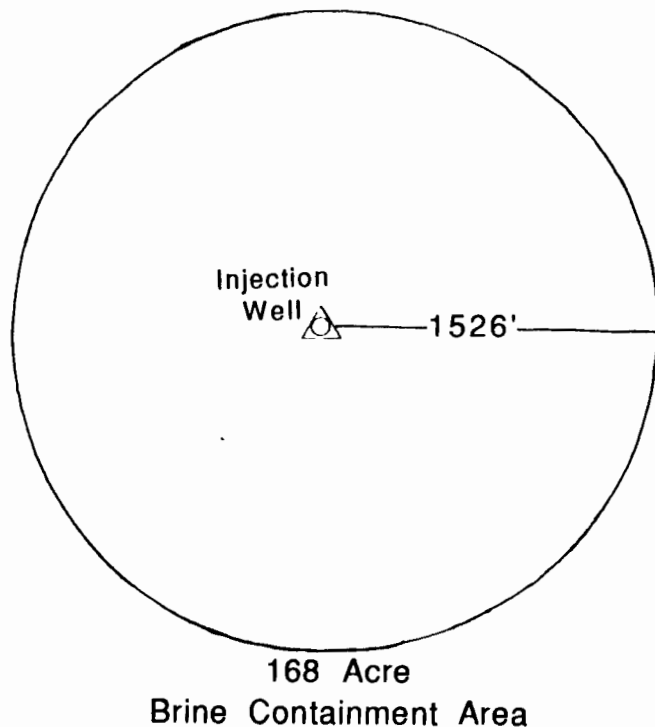
Note: 6,000,000 bbls. is a maximum estimate of the amount of brine injected per well. Low case estimates are 3,500,000 bbls. of brine per injection well. This amount could be contained within a 98 acre confine (radius of 1166'). For the purposes of this permit, the high case numbers were used.

# DISPOSAL ZONES AREA OF BRINE CONTAINMENT

S-SECTION



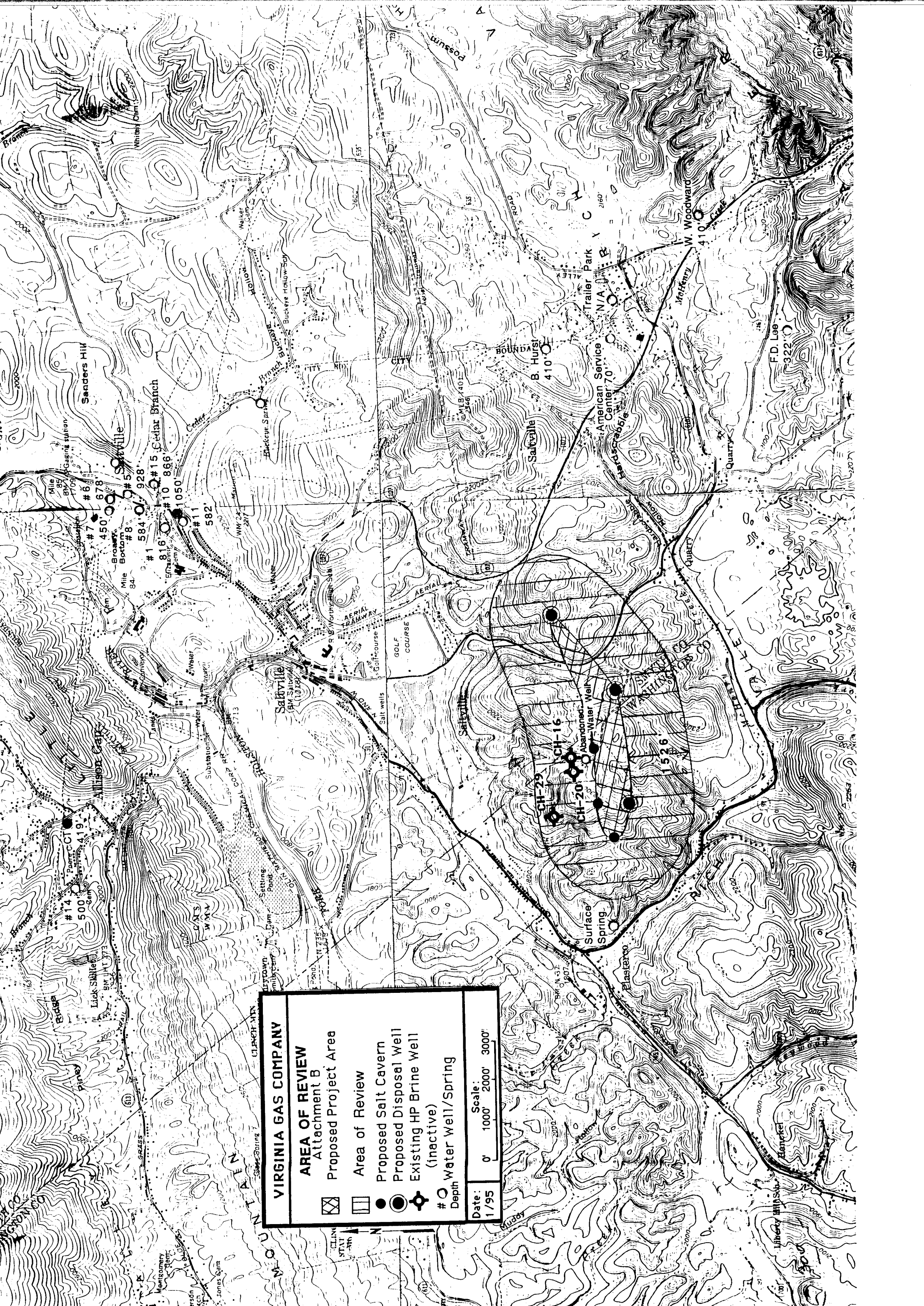
PLAN  
VIEW



**FORM 4**  
**ATTACHMENT B**

**MAPS OF AREA/AREA OF REVIEW**





**VIRGINIA GAS COMPANY**

**AREA OF REVIEW**  
Attachment B  
Proposed Project Area

Area of Review

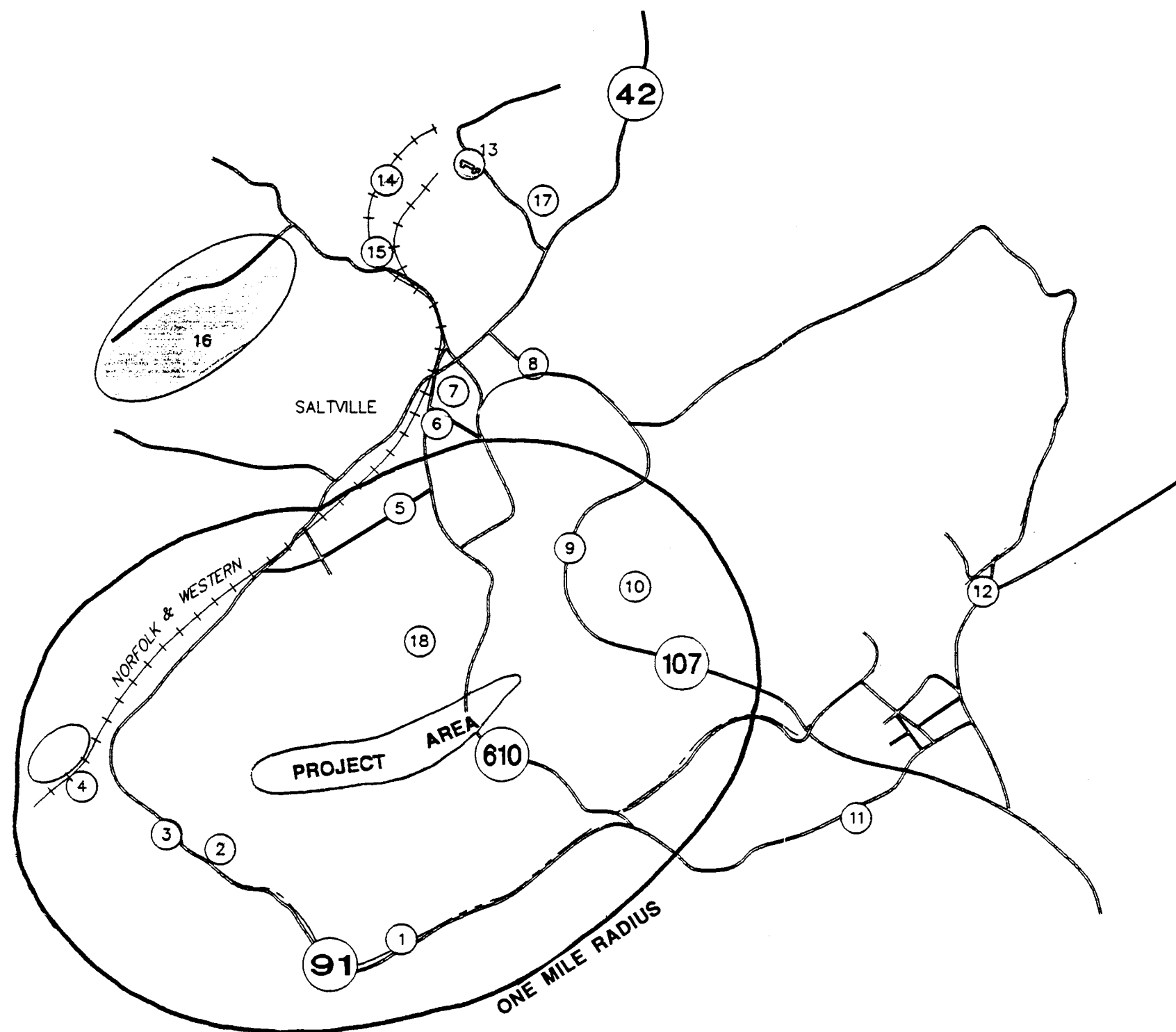
Proposed Salt Cavern

Proposed Disposal Well

Existing HP Brine Well (inactive)

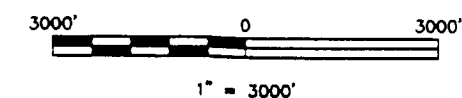
# Water Well/Spring  
Depth

Date: 1/95      Scale: 0' 1000' 2000' 3000'



1. Saltville Motor Sales - Garage repair facility appears to have poor housekeeping
2. Garage building in hollow, strewn about metal and occasional drum, contents unknown
3. Delicatessen and BP Gas Station - underground and above ground petroleum storage tanks
4. U.S. Gypsum Plant
5. Brackish Water Ponds
6. Road intersection with several gas stations, USTs and AST bulk storage facility
7. Town of Saltville
8. Hospital/Medical Center
9. Roadside overlook of Saltville
10. New housing subdivision
11. Muffler repair shop and junk yard Adjacent to abandoned quarry site
12. Jones Repair Shop
13. Texas Gulf Feed Products plant
14. Former Olin-Matheson Chemical Corporation
15. Dotson Wheel Manufacturing Plant
16. Holding lagoons used by Olin-Matheson
17. Suspected hazardous waste dump
18. Core holes # 16 and # 20, abandoned structures and hand dug well

107 - ROUTE NUMBER



# **SITE MAP** SHOWING: **SALTVILLE PROPERTY**

**VIRGINIA GAS**  
**SALTVILLE PROPERTY**  
**SALTVILLE, VA**

Prepared by:  
**W. W. WILSON**  
Geology, Engineering, Geotechnics  
Blacksburg, VA  
Lexington, KY Charleston, WV

Designed: RES	Date: DECEMBER, 1994
Drawn: DWM	
Checked: RES	Scale: 1" = 3000'
Project Number: VV01	P.C. Number: Map Number:

NOTE: The location and dimensions of features shown on this map have been derived from various sources and supplemented by field measurements. Though sufficient for its intended purpose, no claim is made as to the degree of accuracy of this drawing.

**FORM 4**  
**ATTACHMENT C**  
  
**EXISTING WELLS**  
**WITHIN**  
**AREA OF REVIEW**

## **FORM 4**

### **ATTACHMENT C**

#### **WELLS WITHIN THE AREA OF STUDY**

There are three existing wells within the area of review of the project area. Two of these wells, CH-20 and CH-16, were high pressure brine wells operated by the Olin Corporation. They were plugged by Olin in 1972, but were reentered again in 1979 by another company and evaluated for propane storage. They were replugged again in 1981. Virginia Gas Company has currently reentered both wells and is analyzing the existing single coalesced cavity for gas storage potential. The third well, CH-29, was drilled to an approximate depth of 3000' and abandoned when a bit was lost in the hole. Because of the lost bit and the fact that the company was soon going to halt all brine operations in the area, the CH-29 was never completed or used as a brine well. Attached are well histories, including schematics and plugging affidavits. Also included are VGC's daily reports on all re-entry work to date on the CH-16 and CH-20.

#### **CORRECTIVE ACTION PLAN**

The brine fluids and the natural gas being stored will be injected at less than the fracture pressure of the intended formations. The maximum

surface injection pressure will be based on information collected after the commencement of the project. Should this pressure be exceeded or other operating and injection problems be encountered , the following will be undertaken:

- \* Immediately stop all injection and allow the well to stabilize.
  
- \* If the well cannot be stabilized and if the problems encountered cannot be corrected to the satisfaction of the state and federal agencies, the injection well will be plugged as outlined by Attachment Q.
  
- \* Should an inactive well be discovered within the area of review that was not properly plugged, Virginia Gas Company will plug said well in accordance with applicable state and federal regulations.

**WELL HISTORY CH-16**  
**Virginia File # WA-1-ST**

Operator: Olin Mathieson  
Farm: Town of Saltville  
Commence Drilling: January 5, 1957  
Complete Drilling: January 10, 1959  
Elevation: 2145.9'  
T.D. 3977'

CASING		
20"	@	801' 8"
16"	@	1056' 9"
13 3/8"	@	2061' 0"
9 5/8"	@	3877' 0"
5 1/2"	@	4007' 4"
2"	@	4014' 10"

Interconnected with CH-16 on February 5, 1971;  
P&A by Fenix & Scisson for Olin in December, 1972.

Re-entered by MAPCO from December, 1978 to February, 1979;  
Sonar log performed February 20, 1979;  
Plugged by MAPCO June, 1981.

EL. 2145.3

## HIGH PRESSURE BRINE WELL NO. 16

## Club House Hollow

	<u>From</u>	<u>To</u>	<u>Feet</u>	
Cap Rock 938'	0	10	10	Yellow Mud
	10	20	10	Yellow Mud and Limestone
	20	30	10	Black and Gray Limestone
	30	44	14	Gray Limestone
	44	64	20	Dolomite
	64	70	6	Black Limestone
	70	83	7	Black and Gray Limestone
	83	100	17	Dolomite
	100	109	9	Black and Gray Limestone
	109	112	3	Dolomite
	112	141	29	Black and Gray Limestone
	141	154	13	Dolomite
	154	161	7	Black and Gray Limestone
	161	166	5	Dolomite
	166	172	6	Black and Gray Limestone
	172	196	24	Black Limestone
	196	199	3	Dolomite
	199	222	23	Black Limestone
	222	230	10	Dolomite
	230	251	21	Black Limestone
	251	270	19	Dolomite
	270	275	5	Black Limestone
	275	283	8	Dolomite
	283	291	8	Dolomite Black and Gray Limestone
	291	297	6	Gray Limestone
	297	303	7	Dolomite Black and Gray Limestone
	303	316	13	Black Limestone
	316	320	4	Brown Dolomite with Mud
	320	327	7	Black and Gray Limestone
	327	330	3	Gray Limestone with Mud
	330	350	20	Black and Gray Limestone
	350	365	15	Black Limestone
	365	370	5	Black and Gray Limestone with Blue Mud
	370	380	10	Black and Gray Limestone
	380	390	10	Gray Limestone (Hole Caving)
	390	400	10	Black and Gray Limestone (Caving)
	400	402	2	Gray Limestone (Caving)
	402	410	8	Black and Gray Limestone (Caving)
	410	415	5	Gray Limestone (Caving)
	415	430	15	Black and Gray Limestone (Caving)
	430	438	8	Black and Gray Limestone with Mud Seam
	438	442	4	Sandy Limestone (Caving)
	442	450	8	Black Limestone (Caving)
	450	460	10	Gray Limestone (Caving)
	460	470	10	Sandy Limestone (Caving)
	470	473	3	Black and Gray Limestone
	473	483	10	Black Limestone
	483	490	7	Black Limestone with Mud Seam

# HIGH PRESSURE BRINE WELL #16

<u>From</u>	<u>To</u>	<u>Feet</u>	
490	500	10	Black and Gray Limestone
500	509	9	Black Limestone (Caving)
509	514	5	Black Limestone with Mud Seam
514	519	5	Sandy Limestone
519	550	31	Black and Gray Limestone (Caving)
550	558	8	Limestone with Yellow Mud
558	571	13	Dolomite with Mud Seams
571	579	8	Black Limestone
579	597	18	Gray Limestone (Caving)
597	605	8	Gray Limestone with Mud Seams
605	614	9	Black Limestone (Caving)
614	631	17	Gray Limestone (Caving)
631	639	8	Plaster and Gray Rock
639	658	19	Gray Limestone (Caving)
658	661	3	Gray Sandy Limestone and Gypsum
661	669	8	Gray Sandy Limestone and Gypsum
669	678	9	Brown Limestone (Sandy)
678	683	5	No Drillings
683	690	7	Sandy Limestone
690	697	7	No Drillings
697	704	7	Black Limestone
704	715	11	Gray Limestone
715	720	5	Brown and Gray Limestone
720	730	10	Brown Limestone
730	740	10	Gray Limestone
740	749	9	Brown and Gray Limestone
749	759	10	Gray and Black Limestone
759	760	1	Gray Limestone
760	780	20	Black Limestone
780	790	10	Gray Limestone
790	800	10	Gray and Brown Limestone
800	810	10	Black Limestone
810	842	32	Gray Limestone
842	866	24	Gray Limestone with Mud Seam
866	910	44	Gray Limestone
910	938	28	Gray Limestone and Gypsum
938	947	9	Red and Gray Shale
947	997	50	Red and Gray Shale with Gypsum
997	1020	23	Red Shale
1020	1030	10	Red and Gray Shale
1030	1073	43	Red Shale
1073	1093	20	Gray Shale
1093	1100	7	Gray Shale and Gypsum
1100	1150	50	Red Shale
1150	1309	159	Red and Gray Shale
1309	1320	11	Red Shale and Salt 10%
1320	1330	10	" " " " 5%
1330	1360	30	Red Shale
1360	1373	13	Red and Gray Shale
1373	1383	10	" " " " - Salt 10%
1383	1404	21	" " " " - " 25%
1404	1411	7	" " " " - " 10%
1411	1420	9	Red and Gray Shale
1420	1450	30	Gray Shale

## HIGH PRESSURE BRINE WELL NO. 16

## Club House Hollow

<u>From</u>	<u>To</u>	<u>Feet</u>	
1450	1460	10	Gray Shale and Salt 5%
1460	1470	10	" " " " 20%
1470	1474	4	" " " " 50%
1474	1505	31	Gray Shale
1505	1515	10	Gray Shale and Salt 5%
1515	1525	10	" " " " 20%
1525	1545	20	Red Shale
1545	1555	10	Gray Shale and Salt 10%
1555	1562	7	Gray Shale
1562	1565	3	Gray Shale and Salt 20%
1565	1630	65	Gray Shale
1630	1648	18	Red and Gray Shale
1648	1725	77	Gray Shale
1725	1740	15	Gray Shale and Salt 5%
1740	1765	25	" " " " 20%
1765	1770	5	" " " " 75%
1770	1890	120	Gray Shale
1890	1902	12	Gray Shale and Salt 5%
1902	1950	48	Red and Gray Shale
1950	1975	25	Gray Shale
1975	2018	33	Red and Gray Shale
2018	2028	10	" " " " - Salt 5%
2028	2038	10	" " " " - Salt 50%
2038	2045	7	" " " " - Salt 25%
2045	2055	10	" " " " - Salt 50%
2055	2060	5	" " " " - " 70%
2060	2066	6	" " " " - " 20%
2066	2076	10	" " " " - " 80%
2076	2086	10	" " " " - " 20%
2086	2092	6	" " " " - " 60%
2092	2095	3	" " " " - " 10%
2095	2107	12	" " " " - " 90%
2107	2120	13	Gray Shale
2120	2125	5	Gray Shale and Salt 10%
2125	2134	9	Gray Shale
2134	2142	8	Gray Shale and Salt 25%
2142	2163	21	Gray Shale and Salt 75%
2163	2183	20	" " " " 80%
2183	2202	19	" " " " 95%
2202	2214	12	" " " " 100%
2214	2275	61	Gray Shale
2275	2298	23	Gray Shale and Salt 20%
2298	2320	22	Red and Gray Shale
2320	2380	60	Gray Shale
2380	2392	12	Gray Shale and Salt 5%
2392	2440	48	Gray Shale
2440	2656	216	Red and Gray Shale
2656	2662	6	Gray Shale and Salt 20%
2662	2735	73	Gray Shale
2735	2745	10	" " and Salt 30%
2745	2752	7	" " " " 85%

## HIGH PRESSURE BRINE WELL NO. 16

## Club House Hollow

<u>From</u>	<u>To</u>	<u>Feet</u>	
2752	2762	10	Red and Gray Shale
2762	2768	6	" " " " and Salt 20%
2768	2780	12	" " " " and Salt 50%
2780	2790	10	" " " " and Salt 5%
2790	2870	80	Red and Gray Shale
2870	2895	25	" " " " and Salt 5%
2895	2900	5	" " " " 60%
2900	2908	8	" " " " 90%
2908	2930	22	" " " " 100%
2930	2936	6	" " " " 40%
2936	2940	4	" " " " 80%
2940	2950	10	" " " " 100%
2950	2960	10	" " " " 60%
2960	2970	10	" " " " 100%
2970	2980	10	" " " " 30%
2980	3000	20	" " " " 5%
3000	3010	10	" " " " 25%
3010	3030	20	Red and Gray Shale
3030	3040	10	" " " " Salt 10%
3040	3288	248	Red Shale
3288	3298	10	Red Shale and Salt 40%
3298	3304	6	Red Shale
3304	3430	126	Red and Gray Shale
3430	3440	10	" " " " Salt 10%
3440	3450	10	" " " " 5%
3450	3465	15	Gray Shale
3465	3470	5	Gray Shale and Salt 15%
3470	3472	2	" " " " 30%
3472	3522	50	Gray Shale and Gypsum
3522	3568	46	Limestone
3568	3574	6	" " " " Salt 40%
3574	3724	150	Limestone
3724	3740	16	" " " " Salt 5%
3740	3744	4	" " " " 50%
3744	3750	6	Red Shale and Salt 25%
3750	3760	10	Gray Shale and Salt 50%
3760	3770	10	" " " " 5%
3770	3780	10	" " " " 80%
3780	3790	10	" " " " 90%
3790	3795	5	Sandy Limestone
3795	3803	8	Gray Shale and Salt 80%
3803	3810	7	Limestone
3810	3815	5	" " " " Salt 20%
3815	3822	7	Limestone
3822	3826	4	" " " " Salt 75%
3826	3836	10	" " " " Salt 95%
3836	3856	20	" " " " Salt 90%
3856			" " " " Salt 95%

## HIGH PRESSURE BRINE WELL NO. 16

## Club House Hollow

<u>From</u>	<u>To</u>	<u>Feet</u>	
3856	3886	30	Salt 95%
3886	3896	10	" 90%
3896	3936	<del>40</del> 40	" 95%
3936	3946	10	" 80%
3946	3957	11	" 20%
3957			Sand Stone

T.D. 3977

✓

### Abandonment History - Well CH-16

- 11-30-72 Rigged up cementing equipment to 13 3/8" - 9 5/8" annulus and began pumping at 1250 psi. Leak developed in wellhead where 2" collar was welded to 13 3/8" casing head. Moved equipment and bled down well to allow welders to repair leak.
- 12-5-72 Rigged up cementing equipment to 13 3/8" - 9 5/8" annulus, with return through 5 1/2" pipe. Pumped 135 bbls of fresh and salt water at 600 psi without establishing returns through 5 1/2". Hooked up to 9 5/8" - 5 1/2" and pumped 175 bbls of fresh and salt water at 700 psi without establishing circulation through 5 1/2". Hooked up to 5 1/2" and pumped 10 bbls of water at 150 psi to determine if possible to pump into cavity.
- Reconnected to 13 3/8" - 9 5/8" annulus and started cementing operations. Pumped 24 bbls of chemical pre-flush, 6 bbls of gelled water, 20 bbls of 16.8-lb neat cement, 104 bbls of water, and 5 bbls of 16.8-lb neat cement at 200 psi. Connected to 9 5/8" - 5 1/2" annulus and pumped 5 bbls of gelled water, 6.5 bbls of 15.6-lb neat cement, 80.5 bbls of water, and 3 bbls of 15.6-lb neat cement at 100-200 psi. Connected to 5 1/2" casing and pumped 3 bbls of gelled water, 4 bbls of 15.6-lb neat cement, 38.5 bbls of water, and 2 bbls of 15.6-lb neat cement. Found 13 3/8" - 9 5/8" annulus on slight vacuum and cement at surface on both 9 5/8" - 5 1/2" annulus and 5 1/2" casing at end of job.
- 12-6-72 Opened all casing valves and found slight vacuum on 13 3/8" - 9 5/8" annulus. Neither 9 5/8" - 5 1/2" annulus or 5 1/2" casing showed leakage.
- 12-7-72 Hooked up to 13 3/8" - 9 5/8" annulus and pumped less than 1/2 bbl of water. Casing pressured to 1200 psi, and pressure held. Olin to remove all valves and cap with blank flanges, leaving wellhead as abandonment marker. Wellhead will be tagged with well name and number.

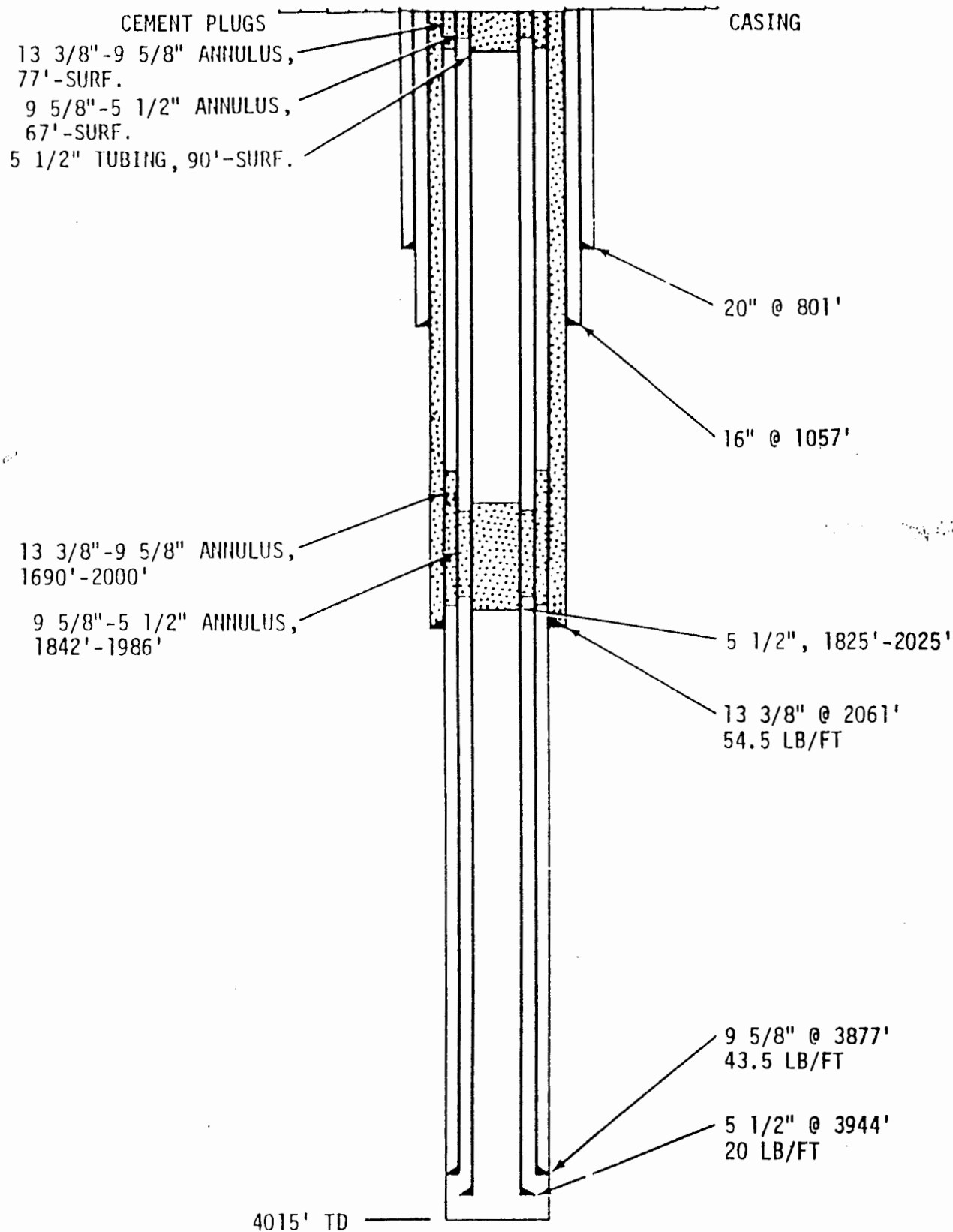


Figure 11. Existing configuration of well CH-16 (Category I).

COMMONWEALTH OF VIRGINIA  
DEPARTMENT OF LABOR AND INDUSTRY  
DIVISION OF MINES  
Big Stone Gap, Virginia

## AFFIDAVIT OF PLUGGING AND FILLING WELL

(Required by Section 45,1-128, Code of Virginia, 1966).

(Affidavit should be made in triplicate. One copy mailed to the Division of Mines, one copy retained by the well operator, and the third copy (additional copies if required) mailed to any (each) interested mine owner or operator.)

Olin Corporation

Mine Operator or Owner

Nasa

Adjoining Well Operator

120 Long Ridge Road

Address

Address

Stamford, Connecticut, 06904

Address

Address

(Submit additional names and addresses, if any, on attached sheet.)

Department of Labor and Industry  
Division of Mines  
Big Stone Gap, Virginia

Olin Corporation

Well Operator

December 11

Date

, 19 72120 Long Ridge Road

Address

Stamford, Connecticut, 06904

Address

Well and Location

9

District

Well No. CH16 - Salt WaterWashington

County

Permit No. \_\_\_\_\_

Saltville

Farm

## AFFIDAVIT

State of Virginia  
County of Smyth } ss.

E. C. Sessions, Fenix & Scisson, Inc. and J. F. Crouch, Dowell, Div. of Dow Chemical Co.

being first duly sworn according to law depose and say that they are experienced in the work of plugging and filling oil and gas wells and were employed by Olin Corporation, well operator, and participated in the

work of plugging and filling the above well, that said work was commenced on the 5th day of December

19 72, and that the well was plugged and filled in the following manner:

(OVER)

SAND OR ZONE  FORMATION	FILLING MATERIAL			PLUGS USED  SIZE AND TYPE	CASING	
	CONTENT	FROM	TO		CGS PULLED	CGS LEFT IN
	6 bbls. gel	2093	2000	None	None	15-3/8" @ 2061'
	20 bbls. cement (120 sks.)	2000	1690			
	5 bbls. cement (30 sks.)	77	Surface			
	5 bbls. gel	2097	1986	None	None	9-5/8" @ 3877'
	6.5 bbls. cement (39 sks.)	1986	1842			
	3 bbls. cement (15 sks.)	67	Surface			
	3 bbls. gel	2240	2025	None	None	5-1/2" @ 3944'
	4 bbls. cement (20 sks.)	2025	1825			
	2 bbls. cement (10 sks.)	90	Surface			
NOTE: ALL STRINGS OF PROTECTIVE CASING WERE LEFT IN HOLE.						
NOT APPLICABLE						
Coal Seams						
(Name)						
(Name)						
(Name)						
(Name)						
(Name)						
(Name)						

DESCRIPTION OF MONUMENT

(Give additional information on supplemental sheet and attach same hereto.)

that the work of plugging and filling said well was completed on the 5th day of December, 1972 that a "bleeder pipe" was (or was not) installed, and that a permanent monument of concrete (or concrete and iron) was erected over the well location in compliance with the provisions of Chapter 12, Title 45, Code of Virginia, 1966.

And further deponents saith not.

J. F. Couch  
 Sworn to and subscribed before me this 12th day of December, 1972  
  
Nila H. Hill  
 Notary Public

My commission expires Sept. 6, 1976

MID-AMERICA PIPELINE COMPANY  
(MAPCO)

CH-16  
RE-ENTRY PROGRAM  
DAILY REPORTS

SALTVILLE UNDERGROUND STORAGE CO.

WELL CH-16

- 12-3-78 Driving from Hobbs, New Mexico to Brinkley, Arkansas.
- 12-4-78 Driving from Brinkley, Arkansas to Saltville, Virginia.
- 12-5-78 Move in Walker D-6 dozer and clear location and start pit. Drilling unit arrives in Saltville at 5:00 p.m., 12-5-78.
- 12-6-78 Widening location to accomodate drilling unit. Move drilling unit from Saltville to pit location. Matting boards with substructure arrives in Saltville late Wed. evening.
- 12-7-78 Appalachian dozer arrives in Saltville at 12:00 noon. Have location cleared and set in drilling unit. Walker has pit finished 12:00 noon. Trailer house, water tank and fuel trailer arrives in Saltville.
- 12-8-78 Rigging up.  
Set in substructure with drilling unit, with fuel trailer, tool house, pipe tubs, set pipe racks and rack. 65 joints 2 7/8", drill pipe, and 4-3 1/2" drill rollers. Raise derrick, (using Appalachian dozer), pump and light plant a in Saltville late Friday night.
- 12-9-78 Rigging up.  
Set in pump and light plant, set in water tank and steel pits. Unload 70 joints, 2 7/8" drill pipe with 8 joints 7 3/8" washpipe and tools. Lay down 4 1/2" kelly and connect up 2 7/8" kelly. Unload 4" water line. (using Appalachian dozer)

# SALTVILLE UNDERGROUND STORAGE CO.

## WELL CH-16

12-10-78 Rigging up, install B.O.P. and nipple up, connect drain lines on tanks and lay water line to pit. Pick up Kelly and Brake. Circulation swivel leaks. Lay down Kelly and pack washpipe. Pick up Kelly, brake. Circulation swivel leaks. Lay down Kelly. Brake Kelly in half laying down. 5:00 P.M. to 8:00 P.M. working on swivel. (Down from 8:00 12-10-78 to 12:30 AM 12-12-78 due to broken Kelly, 28½ hours)

12-11-78 Waiting on Kelly.

12-12-78 Going in hole with bit, collars and drill pipe this AM. Kelly arrives Saltville 10:30 PM 12-11-78. Rig up Kelly on swivel and start drilling cement at surface in 5½" casing at 12:30 12-12-78. Drill 80' cement and fall free. Start going in hole with 2-7/8" drill pipe.

12-13-78 Well flowing to pit this AM made 1107 barrels<sup>2100</sup> water in 9 hours. Casing press. 840#, CH-20 press. 320#. Finish going in hole with bit, drill collars and 51 joints 2-7/8" drill pipe. Tag cement plug at 1690'. Pick up Kelly close Hydril and pressure to 720#. Held o.k. Release pressure, open Hydril and start drilling on cement, plug at 1690'. Drill cement in stringers to 2058' well flows over. Pick up Kelly, close Hydril and 4" flow line valve. Well press. to 625#. Start flowing well through drill pipe, Kelly and Kelly hose at 10:00 PM 12-12-78. Well flowing at rate of 2.05 barrels/minute. Well flowed 1107 barrels water in 9 hours. Flow rate at 7:00 AM 12-13-78 2.05 barrels/minute. Pressure on 5-1/2" x 9-5/8" is 840#, aerated salt water.

Pressure on well 400	
12:10 AM	- 600#
1:00 AM	- 500#
2:20 AM	- 440#
7:00 AM	- 320#

12-14-78 Stripping wellhead to install BOP on 13-3/8" casing this AM. Have 100# on 5-1/2" x 9-5/8. Zero pressure on CH-20 flowing through drill pipe, Kelly and Kelly hose, flow rate from 2.05 bbls/min. to .68 bbls/min. from 7:00 - 11:15 AM. 4-1/2 hr. flow total 222.1 bbls. Open 4" flow line to pit at 11:15 AM 12-13-78.

Flow rate 4.433 bbls/min for 90 min.	398.97 bbls.
Flow rate 3.76 bbls/min for 105 mins.	394.80 bbls.
Flow rate 1.37 bbls/min for 70 mins.	95.90 bbls.
Flow rate 1.37 bbls/min for 70 mins.	95.90 bbls.
Flow rate 1.19 bbls/min for 70 mins.	83.30 bbls.

Well flowed 1290 bbls water in 11 hrs. Total flow measured bbls.

SALTVILLE UNDERGROUND STORAGE CO.

12-17-78 to 12-22-78

12-17-78 Rigging to run mechanical cutter on 3 1/2" collars and 2 7/8" pipe. Wait on McCollough. Rig McCollough and run 5 1/2" csg. Jet cutter and cut 5 1/2" csg at 7'. Pick up 7 3/8" shoe w/7 3/8" - 5' washpipe extensions and start washing over 5 1/2" csg. Washover 72' of 5 1/2" csg. Clear of cement at 53', are recovering salt w/fine shavings of iron at 72', and are rotating down free. Lay down washpipe w/shoe. Go in hole w/McCollough magnitector. Go to 1670', will not go down, are outside of 5 1/2" csg. Setting on top of 2nd plug at 1842' - 1986'. Lay down magnitector and run 5 1/2" csg. jet cutter. Are unable to go lower than 28', are setting down solid.

12-18-78 Waiting on shoe to dress top of fish for outside cutter. Wait on cutter. Pick up 5 1/2" tri-state inside mechanical cutter on Kelly and go in hole unable to go lower than 28'. Have collapsed 5 1/2" csg w/Jet shot that parted 5 1/2" csg at 7'. Pick up 5 1/2" outside csg. cutter and go in hole w/1 jt. 7 3/8" washpipe. Set down on top of fish. Unable to go over fish. Have run washover shoes w/6 3/8" I.D. I.D. of outside cutter 6 1/8". Level derrick back over hole. 12 hrs. waiting on cutter. 7 hrs. waiting on shoe to dress 5 1/2" csg for outside cutter. (Down 19 hrs.)

12-19-78 Waiting on 8 1/8" O.D. outside cutter this A.M. Pick up 7" O.D. shoe dressed to 6" I.D. and go over top of fish at 7'. Dress top of fish. Pick up 7" outside cutter, are unable to go over fish w/cutters. Lay down and brake down cutter try to run cut off 5 1/2" csg w/collar by cutters. Are able to pass 5 1/2" O.D. body of csg., but 6" O.D. collar will not pass. 8 hrs. waiting on shoe, 10 hrs. waiting on 8 1/8" O.D. cutter. (Down 18 hrs.)

12-20-78 Laying down 5 1/2" csg. this A.M. Pick up 8 1/8" outside cutter for 5 1/2" csg. and go in hole w/1 jt. 7 3/8" washpipe w/3 - 7 3/8" x 5' extensions. Go over and pick up to 5 1/2" csg collar at 47' cut 5 1/2" csg. at 48'. Lay down extensions, lay down 38' cut 5 1/2" csg. Lay down 1 jt. 7 3/8" washpipe and 8 1/8" outside cutter. Pick up 5 1/2" mechanical inside cutter w/2 stds. 3 1/2" drill collars and go in hole w/24 stds. 2 7/8" drillpipe and 1 single. Pick up Kelly and cut 5 1/2" csg at 1671'. Lay down Kelly and trip out of hole w/1 single and 24 stds. 2 7/8" drillpipe and 2 - 3 1/2" drill collars w/5 1/2" inside cutter. Pick up 5 1/2" center spear and go in hole w/1 - std. 3 1/2" collars and 1 jt. 4 1/2" drillpipe. Latch on to 5 1/2" csg at 48' and pick up. Have 30,000# pick up, have fish. Lay down drillpipe, collars and center spear w/cutoff joint. Rig to lay down 5 1/2" csg. and lay down 52 jts. 20' 5 1/2" csg.

12-21-78 Washing over at 1755' this A.M. Top cement 1720'. Finish laying down total of 74 jts. 5 1/2" csg. Pick up 7 3/8" shoe w/5 jts. 7 3/8" washpipe w/1 - 7 3/8" x 5' extension w/2 - 5 1/2" drill collars and go in hole picking up 48 jts. 4" drillpipe. Pick up Kelly and break circulation. Go over fish at 1671' and washdown to 1720' make 59'. Are torqueing up and unable to go down. Lay down Kelly and trip out of hole w/24 stds. 4" drillpipe, 1 std. 5 1/2" collars w/2 - stds. and 1 single of 7 3/8" washpipe and shoe. Shoe is worn w/ broken uneven bottom. Pick up 7 3/8" rebuilt shoe w/2 - stds. and 1 single of 7 3/8" washpipe, 1 - std. 5 1/2" collars and go in hole w/24 stds. 4" drill pipe. Tag up and start washing over at 1720', make 35' to 1755'. Top cement plug at 1720'.

12-14-78 (cont'd).

Well Pressures	CH-16	CH-20
12:00 Noon	540#	250#
2:00PM	530#	130#
5:00PM	400#	20#

Lay down Kelly and go in hole with bit, 4 - 3-1/2" drill collars and total of 114 joints 2-7/8" drill pipe. Have restriction in 5-1/2" casing at 3647' and work through and set down at 3668', lay down 1 joint 2-7/8" drill pipe. Pick up Kelly and rotate down. Unable to rotate lower than 3668', are torqueing up with Kelly. Lay down Kelly and 1 joint 2-7/8" drill pipe and trip out of hole with 56 stds. drill pipe and 2 stds. 4-1/2" drill collars with 4-1/8" bit. Have iron shavings on teeth of bit.

12-15-78 Preparing to cut 5-1/2" stub for washpipe working room, stripping wellhead, cutting off 5-1/2" and 9-5/8" casing weld thd. on 13-3/8" casing; install 12" flange with 12" x 900 BOP and nipple up lay down 3" Kelly and pick up 4-1/2" Kelly. Start washing over 5-1/2" casing at surface. Unable to get bushings in rotary table, turning Kelly with rig tongs. Make 8', lay down washpipe extensions and shoe lay down 4-1/2" Kelly and pick up 3" Kelly.

12-16-78 Working 5-1/2" casing via center spear at 7' this AM. Pick up Tri-State 5-1/2" casing cutter. On 3" Kelly and make attempt to cut 5-1/2" casing at 7' with hydraulic casing cutter; make three attempts to cut 5-1/2" casing, are brakes on cutter, pick up 5-1/2" mechanical cutter, run on 5-1/2" casing for 2-1/2 hours. Attempt to pull 5-1/2" casing with 60,000#, 5-1/2" casing is not cut. Run mechanical cutter on 5-1/2" casing for 6 hours. Attempt to pull 5-1/2" casing, is not cut. Call McCollough for jet cutter

SALTVILLE UNDERGROUND STORAGE CO.

12-17-78 to 12-22-78 Cont'd.

12-22-78 Are closed down for Christmas and New Years. Are torqueing up and unable to go down at 1755'. Lay down Kelly and trip out of hole w/24 stds. and 1 single of 4" drillpipe, 1 std 5 1/2" collars w/2 - stds. and 1 single of 7 3/8" washpipe and shoe. Shoe is worn free of all cutting material. Pick up 7 3/8" shoe w/2 - stds. and 1 single of 7 3/8" washpipe, 1-std 5 1/2" collars and go in hole w/24 stds. and 1 single 4" drillpipe. Pick up Kelly and start washing over at 1755'. Wash to 1800'. Shoe is torqueing up and will not go down. Trip out w/drillpipe, collars and washpipe. Shoe is worn out. Pick up tri-state inside cutter w/2-stds. 3 1/2" drillcollars and 25 stds. 2 7/8" drillpipe. Go into 5 1/2" csg. at 1671', go down 25', unable to work cutter down to make cut at 1790'. Trip out w/drillpipe, collars, and 5 1/2" inside cutter. Pick up 7 3/8" rerun shoe, washpipe, collars and 4" drillpipe. Go over fish at 1671' and go to 1800' to clear for outside cutter. Trip out of hole w/drillpipe, collars, washpipe and shoe. Pick up 8 1/8" outside cutter w/2 stds. and 1 single 7 3/8" washpipe, 1 std. 6" collars and 4" drillpipe. Tag top of 5 1/2" csg. at 1671'. Go over to 1800' and pick up against collar at 1772' and cut 5 1/2" csg. at 1773'. Trip out of hole w/drillpipe, collars, washpipe, and outside cutter w/102' 5 1/2" csg., shoe has started to cut wall of 5 1/2" csg. in last 30'. Have not reached cement plug. Are in iron scale from csgs. Pick up 1 jt. 4" drillpipe and close rams on B.O.P. Install tool joint w/4" line pipe tbg. and install 4" x 2" Swedge w/ball valve. Close down til 1-2-79.

# SALTVILLE UNDERGROUND STORAGE COMPANY

WEIJ. CH-16

- 1-2-79 Leave Lubbock 6:55 a.m. central standard time, arrive in Saltville Va. 4:00 p.m. eastern standard time. 1-1-79.
- 1-3-79 Waiting on shoe at 1804' this a.m. Start operations 8:00 a.m. 1-2-79. Well closed in, have 20# press on CH-16. 0# press on CH-20. Open well to pit and flow back 89bbls. (26"). Pick up 7 3/8" shoe with 2-stds. and 1 single with 5' stds. 4" drill pipe tag top 5 1/2" stub. at 1773'. Lay down 1 jt. 4" drill pipe and pick up kelly. Go over stub at 1773' and start washing over 5 1/2" csg. at 1800' make 4' in 3 hrs., shoe stops milling. Trip out of hole with drill pipe, collars and washpipe with shoe. Shoe wear indicates we are splitting 5 1/2" csg. Shoe cutting surface too thick to wash along side 5 1/2" csg. Are recovering iron cuttings with cement, indicates 5 1/2" csg. along side of 9 5/8" csg. space 1/4" from 9 5/8" wall by 5 1/2" csg. collars. Waiting on shoe with flush d.d. with kut-rite bottom and i.d.
- 1-4-79 Milling at 1811' this a.m. Six hours thawing out rotary table. Pick up 7 3/8" O.D. shoe on 1 single and 2 stds. with 1-5' extension of 7 3/8" washpipe with 1 stds. 5 1/2" collars and go in hole with 4" drill pipe. Pick up kelly and start washing over 5 1/2" csg. Wash on csg. for 5 hours, make 5' are cutting on junk. Have shoe worn out. Trip out with drill pipe, collars and washpipe with shoe. Shoe is worn and rolled to I.D. Pick up 7 3/8" shoe and go in hole with washpipe. Drill collars and drill pipe pick up kelly and start washing over, make 2' in 1 hour.
- 1-5-79 Waiting on spear to fish 7 3/8" washpipe this a.m. Wash over 5 1/2" csg. for 6 1/2 hours. Washover to 1820' shoe wore out. Lay down kelly and trip out with drill pipe, collars, washpipe and shoe. Pick up 8 3/8" O.D. shoe and go in hole with washpipe, drill collars and drill pipe. Pick up kelly and start washing over 5 1/2" csg. at 1820' torque up on shoe pick up. Have lost 2000# string weight. Trip out of hole with drill pipe and collars. Have twisted off 7 3/8" washpipe at top bushing.
- 1-6-79 Waiting on dozer this a.m. Pick up spear for 7 3/8" washpipe with jars, drill collars and drill pipe and go in hole. Latch onto 7 3/8" washpipe at 1664'. Pick up washpipe with shoe and trip out of hole with drill pipe, collars, jars and spear. Lay down 5 jt 7 3/8" washpipe and shoe, repair sweivel, waiting on 8 1/8" washpipe.
- 1-7-79 Washing over at 1839' this a.m. Pick up 8 3/8" shoe with 9 jts 8 1/8" washpipe with 1 std. 5 1/2" drill collars and go in hole with 23 stds. and 1 single of 4" drill pipe. Pick up kelly and start washing over 5 1/2" csg at 1820' wash to 1839' made 19.

1 79

Waiting on shoe at 1845' this a.m. Lay down kelly and trip out of hole with 24 stds. of 4" drill pipe with 1 std. 5 $\frac{1}{2}$ " collars 4 stds. and 1 single of 8 1/8" washpipe and 8 3/8" shoe. Shoe worn out. Pick up 8 3/8" shoe and go in hole with washpipe, drill collars and drill pipe. Pick up kelly, start washing over at 1842' mill on pipe for 1 $\frac{1}{2}$  hours. Make 1' to 1843' shoe start torqueing up, unable to make any penetration. Trip out of hole with drill pipe, collar and washpipe with shoe. Shoe has shucked kut-rite. Pick up kelly and start milling on 5 $\frac{1}{2}$ " csg. at 1845' shoe starts torqueing up, unable to make any penetration. Trip out of hole with drill pipe, collars, washpipe and shoe. Shoe has shucked kut-rite. Waiting on shoes this a.m.

SALTVILLE UNDERGROUND STORAGE CO.  
WELL CH-16

- 1-9-79 Going in hole with shoe at 1859' this a.m., 5 hours waiting on shoe. Go in hole with 8 3/8" shoe with 8 1/8" washpipe, with roll collars and drill pipe. Pick up kelly and start washing over. 5 1/2" csg. at 1845' makes 14' in 10 hours. Shoe starts torqueing, are unable to penetrate. Trip out of hole with drill pipe, collars, washpipe and shoe. Have cut off with 2 jts. 5 1/2" csg. wedged in washpipe, no collars and csg. Pipe has worn through itself at collars and forced wedge in washpipe. Recover 63' 5 1/2" csg. have stub in hole 1836' with partial collar looking up. Have washed to 1859'.
- 1-10-79 Milling on 5 1/2" csg. at 1872' this a.m. Made 13' in 7 hours starting engine on drilling unit. Finish trip in hole with shoe mill on junk for 1 1/2 hours make 3' wear out shoe. Trip out with drill pipe, collars, washpipe and shoe. Shoe worn but not broken, four hours waiting on shoes. Pick up 8 3/8" shoe with washpipe, collars and drill pipe. Pick up kelly and start milling on 5 1/2" csg. Mill to 1872', making total of 13' in 7 hours.
- 1-11-79 Going in hole with shoe at 1879', made 7' this a.m., wore out shoe, trip out of hole with drill pipe, collars, washpipe and shoe. Shoe worn out, no brakes. Pick up shoe with washpipe, collars, and drill pipe. Pick up kelly and start milling. Shoe starts out torqueing up and does not make any hole. Trip out of hole with drill pipe, collars, washpipe, and shoe. Shoe has show of wear on inside edge of bottom not worn, wait 8 hours for shoes.
- 1-12-79 Milling at 1903' this a.m., made 24'. Trip in hole with shoe, washpipe, drill, collars, and pipe. Pick up kelly and start milling on 5 1/2" csg. at 1897' mill to 1900'. Shoe starts torqueing and unable to penetrate. Trip out with drill, collars, washpipe and shoe. Shoe worn, but not broken. Pick up shoe with washpipe, collars, and drill pipe. Pick up kelly and start milling on 5 1/2" csg. at 1903'.
- 1-13-79 Waiting for part to repair pump motor. 24 hours rig repair.
- 1-14-79 Going in hole with shoe at 1911' this a.m. Made 8' in 10 hours. Rig repair. Start milling on 5 1/2" csg. at 6:00 p.m. 1-14-79. Mill on shoe for 3 hours. Shoe torques up and hangs. Pick up 5000# additional weight. Pick up kelly, pull 20,000# above weight of string, pipe becomes free. Trip out with drill pipe, collars, washpipe and shoe. Shoe has a 3 1/2" X 9" section broken from bottom and had wedged on O.D. of washpipe. Go in hole with shoe, washpipe, collars and drill pipe. Pick up kelly and start washing on junk at 1903' wash on junk and 5 1/2" csg. for 6 hours to 1911'. Have worn out junk and shoe. Trip out with drill pipe, collars, washpipe and shoe. Shoe worn, but not broken.

1-15-79

Milling on 5½" csg. at 1911' this a.m. Go in hole with shoe washpipe, collors and drill pipe. Tag up on 5½" fish at 1864', lack 47' reaching mill out depth at 1911', attempt to work over. Pick up kelly and start milling, make 1'. Are milling csg. have 1 jt 5½" csg beside 5½" csg at 1846'. Trip out with drill pipe, collors, washpipe and shoe. Pick up overshot with jars, bumper sub, collors, and drill pipe. Go in hole. Tag top of fish at 1846', work fish down hole to 1857'. Trip out with drill pipe, collors, bumper sub, jars and overshot. Recover 1 jt. 5½" seg 21' long. Go in hole with overshot, jars, bumper sub, collors and drill pipe. Tag 5½" fish at 1875' work overshot to 1878'. Trip out of with drill pipe, collors, bumper sub, jars and over shot. Recover 2 jts, 5½" csg. 5½" fish has over passed itself for 10'. Lay down fishing tools. Pick up shoe with 2 jts. 8 1 washpipe, with collors and drill pipe and go in hole. Start milling on 5½" csg. at 1911'.

SALTVILLE UNDERGROUND STORAGE CO.  
CH-16

- 1-16-79 Trip out with overshot from 1901' this a.m. Mill out depth 1933' made 22'. Mill on 5½" csg. from 1911' to 1914' shoe starts spinning unable to go down. Trip out of hole with drill pipe, collors, washpipe and shoe. Shoe worn but not broken. Go in hole with shoe, washpipe, collors and drill pipe, collors, washpipe and shoe. Shoe worn out but not broken. Pick up overshot with jars, and bumper sub, collors, and go in hole with drill pipe. Pick up kelly and tag top 5½" fish at 1901'. Start out of hole with drill pipe.
- 1-17-79 Milling on 5½" csg. at 1953' this a.m. Made 20'. Finish trip out of hole with drill pipe, collors, bumper sub, jars and overshot. Recover 1 jt. 5½" csg. for 21'. Go in hole with shoe, washpipe, collors, and drill pipe. Pick up kelly and start milling on 5½" csg. at 1933' mill to 1946'. Shoe worn out. Pick up kelly and start milling at 1946' mill to 1953'. Shoe worn out. Trip out with drill pipe, collors, washpipe, and shoe. Shoe worn out not broken. Pick up overshot, jars, bumper sub, collors and go in hole with drill pipe. Tag fish at 1922'. Trip out of hole with drill pipe, collors, bumper sub, jars and over shot. Recover 21'-5½" csg. with csg. collar wrapped around bottom of jt. Pick up shoe, washpipe, collors, and go in hole with drill pipe. Pick up kelly.
- 1-18-79 Mill on 5½" csg. at 1969' this a.m., made 16'. Start milling on 5½" fish at 1953', mill to 1964'. Shoe worn out. Trip out of hole with drill pipe, collors, washpipe and shoe. Shoe worn with 2½" X 6" section broken from bottom. Pick up overshot, jars, bumper sub and drill collors, and go in hole with drill pipe. Latch onto fish at 1942', pick up on fish to 80,000#. Washed over jt. is not free. Trigger jars above pipe by 50,000#, unable to knock csg. jt. loose from scg. collar at 1963'. Release over shot and trip out of hole with drill pipe collors, bumper sub, jars and overshot. Pick up shoe with washpipe and collors and go in hole with drill pipe. Pick up kelly and start milling on 5½" csg. at 1964'. Mill to 1969' shoe worn out, is hanging and torqueing up. Trip out of hole with drill pipe, collors, washpipe, and shoe. Shoe worn with 2" X 4" section broken from bottom. Pick up overshot, jars, bumper sub and drill collors and go in hole with drill pipe. Latch on to fish at 1942'. Pick up on fish to 80,000# on washed over csg. Csg. is not free, trigger jars above pipe weight by 50,000# unable to knock scg. loose. Trip out of hole with drill pipe, collors, bumper sub, jars, and overshot. Pick up shoe, washpipe and collors, and go in hole with drill pipe. Pick up kelly, start milling on fish at 1969!

1-19-79 Going in hole with skirted mill this a.m. at 1969'. Mill over 5½" csg. at 1969', make no footage. Shoe torqueing and sticking are milling on junk. Lay down kelly and trip out of hole with drill pipe, collors, washpipe and shoe. Shoe worn and broken. Pick up 5½" inside cutter with 2 stds 3½" drill collors and go in hole with 31 stds. 2 7/8" drill pipe. Unable to go into 5½" csg. stub at 1942'. Trip out of hole with 2 7/8" drill pipe, collors and inside cutter. Pick up 5½" X 8 1/8" outside cutter on 2 jts, 8 1/8" washpipe with 5½" drill collors and go in hole with 4" drill pipe. Go over stub at 1942' and tag junk in hole, at 1967'. Have lost 2' hole. Unable to pass dags on outside cutter past collar at 1964' (Dogs on cutter are 3' above bottom of cutter out of hole with drill pipe, collors, washpipe and outside cutter. Ten hours waiting on skirted mill. Make up mill on drill collors and start in hole.

1-20-79 Waiting on McCollough this a.m. Finish trip in hole with drill pipe and tag top of stub on 5½" csg. at 1942'. Ream out top of stub and clear 5½" csg. to 6'. Trip out of hole with drill pipe and collors. Lay down skirted mill. Pick up 4 5/8" o.d. Mill on 3½" drill collors and go in hole with 2 7/8" drill pipe. Tag top 5 ½ csg. at 1942', go through stub and clear inside 5½" csg. to 2083'. Trip out with drill pipe, collors and mill. Pick up 5½" inside with collors and in hole with drill pipe. Go into 5½" csg at 1942' and cut 5 csg. at 1995'. Trip out of hole with drill pipe, collors, and inside cutter. Pick up overshot, jars, bumpersub with drill collors and go in hole. Latch onto 5½" csg. at 1942' pick up on 5½" csg. to 100,000# is not free. Start working jars to 100,000# with straight pulls to 140,000#, work jars for 1 hour, have moved pipe 1'. Shuck jars and are unable to 5½" csg. Pick up to release overshot, are unable to release overshot due to pipe turning. Unable to fowl pipe enough to rotate overshot from fish. Wait on McCollough to free point to back off. 5½" csg.

1-21-79 Waiting on 3 3/4" grapple for overshot this a.m. Six hours waiting on McCollough. Ho in hole with magna-tector. Pick up csg. collors at 2048, 2028, 2006.5, 1985.5 and 1964' find free point in scg. at 1969'. Over shot on 5½" csg is not releasing. Back of overshot. Trip out of hole with drill pipe, collors, bumper sub, jars and overshot. Pick up 4 5/8" mill and go in hole with 3½" collors and 2 7/8" drill pipe, collors and mill. Mill has concave sides to 3 7/8" top of fish is rolled to i.d. to 3 7/8". Pick up tapered mill with skirt and go in hole with drill collors and drill pipe. Pick up kelly and start swedging and dressing i.d. of 5½" csg. Mill torques up and starts spinning. Make total of 1' with 2 mills on i.d. of 5½" csg stub. Lay down kelly and trip out of hole with drill pipe, collors, and skirted mill.

Have backed off stem on 4 5/8" tapered mill at top bushing of skirt. Waiting on grapple for overshot.

1/22/79 Waiting on cutlip guide for overshot this a.m. 10 hours waiting on grapple. Pick up overshot w/jars, bumper sub w/drill collors and go in hole w/drill pipe. Pick up Kelly and try to catch stem on tapered mill. Guide goes over stem but grapple will not pass. Trip out of hole w/drill pipe collors, bumper sub, jars, and overshot. 10 hours waiting on guide.

SALTVILLE UNDERGROUND STORAGE CO.  
WELL CH-16

- 1/23/79 Milling on 5½" casing stub this a.m. 6 hours waiting on Kut-Rite guide for overshot. Pick up overshot, jars, bumpersub w/collors and go in hole w/drill pipe. Pick up Kelly and rotate down over fish and pick up. Trip out of hole w/drill pipe. Collors and overshot do not have fish. Make four additional runs w/overshot. Recover tapered mill w/extensions on fifth run w/overshot. Pick up 8½" O.D. flat bottomed mill w/drill collors and go in hole w/drillpipe. Pick up Kelly and start milling on 5½" casing stub at 1942'.
- 1/24/79 Going in hole w/skirted mill this a.m. 8 hours milling on 5½" casing stub from 1942' to 1948'. Lay down Kelly and trip out of hole w/drillpipe, collors and 8½" flat bottom mill. Pick up 5½" inside cutter w/two studs. 3½" collors and go in hole. Pick up Kelly, attempt to go in stub at 1942', are unable to clear stub w/cutter. Trip out of hole w/drillpipe, collors and inside cutter. Blow engine on light plant at 9:00 p.m. 1/23/79. Down eleven hours due to light plant.
- 1/25/79 Rotating and circulating in 5½" casing w/4 5/8" mill this a.m. Finish trip in hole w/skirted mill. Dress stub of 5½" casing w/skirted mill. Trip out hole w/drillpipe, collors and skirted mill. Pick up 5½" inside cutter with collors and go in hole w/drillpipe. Go into 5½" stub at go down 13', cutter will not go below 1961'. Trip out of hole w/drillpipe, collors and cutter. Pick up 4 5/8" mill with 3½" collors and go in hole with 2 7/8" drillpipe. Pick up Kelly and start rotating and circulating on plug at 1961'.
- 1/26/79 Going in hole with 8" magnet this a.m. Rotating and circulating through 5½" casing from 1961' to 1967' brakes thru' run 4 5/8" mill to 3668'. Trip out of hole with drillpipe, collors and mill. 5 hours waiting on 5½" inside cutter. Pick up 5½" inside cutter on 3½" collors and go in hole with 2 7/8" drill pipe. Cut 5½" casing at 19 Trip out of hole w/drillpipe, collors and 5½" cutter. Pick up overshot w/jars, bumper sub on collors and go in hole w/drillpipe, latch onto 5½" casing at 1948'. Pull free and trip out of hole w/drillpipe, collors, bumper sub, jars and overshot. Have recovered 16' 5½" casing, no casing collar on bottom of 5½" casing. Pick up 8" magnet on collors and start in hole w/drillpipe.
- 1/27/79 Milling over 5½" casing at 1978' made 8'. Finish trip in hole with 8" magnet, collors and drillpipe. Tag up on 5½" at 1965' have cut 5½" casing 5' short. Trip out of hole w/drillpipe, collors, and magnet. No recovery of magnet. Pick up 5½" inside cutter w/collors and drill pipe. Pick up Kelly and cut 5½" casing at 1970', trip out

with drillpipe, collors, and cutter. Pick up 5½" center releasing spear and go in hole with two stds. 3½" collors and 2 7/8" drillpipe. Latch onto 5½" casing at 1965'. Pull up to 80,000 # work pipe at 80,000 # (55,000 # above string weight.) work casing free. Trip out of hole with drillpipe, collors and spear. Have 5' of 5½" casing with casing collar on top. Pick up 8" magnet on collors and go in hole with drillpipe. Tag bottom with magnet at 1965'. Trip out of hole w/drillpipe, collors and magnet. Recover 1" accumulated iron filings on base of magnet. Pick up 8 3/8" shoe with 2 jts. 8 1/8" washpipe on collors and go in hole w/drillpipe. Pick up Kelly and start mill on cem at 1965' mill to 1970' and start washing over 5½" casing mill to 1978'. Made 8' in 8 hours.

1/28/79 Going in hole w/overshot this a.m. At 1989' made 11'. Washing over 5½" casing for 2 hours made 1', shoe worn out. Trip out of hole w/drillpipe, collors, washpipe, and shoe. Shoe worn out but not broken. Pick up shoe with washpipe, collors and go in hole w/drillpipe. Pick up Kelly and start washing over 5½" casing at 1979' wash to 1989', made 10' in 10 hours. Shoe worn out. Trip out of hole w/drillpipe, collors, washpipe, and shoe. Shoe worn but not broken. Pick up overshot w/jars, bumper sub, coll and start in hole w/drillpipe.

1/29/79 Waiting on water this a.m. at 2020' made 31'. Finish trip in hole w/overshot. Latch onto fish. Trip out of hole w/drill pipe, collors, bumper sub, jars, and overshot. Recover two sections of 5½" casing 6' long wedged in overshot side by side. Pick up shoe, w/washpipe, collors and go in hole w/drillpipe. Start washing over 5½" casing at 1989' Wash to 2020', made 31' in 6 hours. Have run out of water to circulate with. Are unable to circulate out cuttings and are sticking washpipe. Trip out of hole w/drillpipe, coll extended washpipe to 6 jts. (175') and go in hole with collors and drillpipe. Waiting on water.

# SALTVILLE UNDERGROUND STORAGE CO.

CH-16

- 1-30-79 Picking up outside cutter this a.m. at 2008', six hours waiting on water. Start washing over 5½" csg. at 2020', wash to 2028', made 8'. Washpipe starts torqueing. Trip out of hole with drill pipe, collars, washpipe, and shoe. Shoe worn and broken. Pick up overshot, jars, bumper sub, and collars. Go in hole with drill pipe. Latch onto 5½" csg. at 1989'. Pick up to 80,000#, unable to work free, work jars to 80,000#, unable to work free. Work string to 80,000#, have stretch in csg., trip out of hole with drill pipe, collars, bumper sub, jars, and overshot. Pick up 5½" inside cutter on 3½" collars and go in hole with 2 7/8" drill pipe. Unable to go into 5½" stub at 1989'. Trip out of hole with drill pipe, collars and inside cutter. Pick up 5½" outside cutter on washpipe.
- 1-31-79 Waiting on tools this a.m., at 2028'. Finish picking up outside cutter with washpipe, and collars. Go in hole with drill pipe, go over stub at 1989' and pass 5½" csg. collars at 2006'. Pick up on cutter and cut 5½" csg. at 2008'. Trip out of hole with drill pipe, collars, washpipe, and outside cutter. Recover 19' 5½" csg. with bottom, cut 2' below csg. collars. Pick up 5½" inside cutter on 3½" collars. Go in hole with 2 7/8" drill pipe, tag top 5½" csg. at 2008' cutter will not go inside 5½" csg. Trip out with 2 7/8" drill pipe, collars and inside cutter. Pick up 4 5/8" skirted mill on 3 ½" collars. Go in hole with 2 7/8" drill pipe. Tag up on 5½" csg. at 2008'. Pick up kelly and dress top of 5½" csg. with 4 5/8" skirted mill. (5½" csg. is settling along side of 9 5/8" csg. 5½" csg. pulled from 1989 to 2008' showed no indication of mill wear from Kut-Rite shoe. Have junk wedging 5½" csg. to 9 5/8" csg. at 2028'.) Trip out of hole with drill pipe, collars and skirted mill. Pick up 5½" inside cutter on 1 std. 3½" collars and go in hole with 2 7/8" drill pipe. Tag 5½" csg. at 2008'. Unable to work, inside cutter into 5½" csg. laying along side of 9 5/8" csg. Trip out of hole with drill pipe, collars and inside cutter. Pick up 4 5/8" skirted mill and go in hole with collars on drill pipe. Pick up kelly and dress top of 5½" csg. at 2008'. Trip out of hole with drill pipe, collars and skirted mill. Six hours waiting on tools.
- 2-1-79 Trip out with inside cutter this a.m. at 2028'. Six hours waiting on tools. Pick up 4 5/8" mill with 6' extension with inside cutter with 3½" bumper sub on 3½" collars and go in hole with 2 7/8" drill pipe. Tag top 5½" csg. at 2008', work mill and inside cutter thru 5½" stub. Run to 2078'.

Pick up kelly and cut 5½" csg. at 2075'. Trip out of hole with drill pipe, collars, inside cutter and mill. Pick up overshot with jar, bumper sub, collars and go in hole with drill pipe. Tag top of 5½" csg. at 2008'. Latch onto fish, pull 6,000# above weight of string pulls loose. Trip out of hole with drill pipe, collars and bumper sub, jars and overshot. Do not have fish, have shucked overshot. Make ~~two~~ more runs with overshot. 1st run with 5 1/4" grapple and 2nd with 5½" grapple. Latch on to fish and pull to 100,000#, are not free. Start working jars at 100,000#, 60,000# above string weight. Work jars for 1 hour, unable to move fish. Release overshot and trip out with drill pipe, collars, and bumper sub, jar and overshot. Pick up 4 5/8" mill on inside cutter on 3½" collars and go in hole with 2 7/8" drill pipe. Tag top of 5½" csg. at 2008'. Work mill and inside cutter thru 5½" csg. stud. Pick up kelly and cut 5½" csg. at 2030'. Start out of hole with drill pipe.

2-2-79

Trip out with overshot, this a.m. at 2028'. Finish trip out of hole with drill pipe, collars and cutter with mill guide. Pick up overshot, jars, bumper sub, and collars and go in hole with drill pipe. Latch onto 5½" csg. at 2008'. Pick up to 80,000#, are not free. Start working jars at 80,000# to 100,000#. Knock 5½" csg. free. Trip out of hole with drill pipe, collars bumper sub, jars and overshot. Have shucked overshot. Redress overshot. Run overshot with jars, bumper sub, 4-5½" drill collars and accelerator on 4" drill pipe. Latch onto 5½" csg. at 2008'. Jar on 5½" csg. for 12 hours, triggering jars from 100,000# to 120,000#. Are unable to free 5½" csg. Release overshot and start out of hole with drill pipe.

2-3-79

Waiting on 5½" inside cutter this a.m. at 2028'. Finish trip out with drill pipe, accelerator collars, bumper sub, and overshot. Pick up 4 5/8" mill on 5½" inside cutter on drill collars and go in hole with drill pipe. Go into 5½" csg. at 2008' and cut 5½" csg. at 2027'. Trip out of hole with drill pipe, collars with cutter and mill. Pick up overshot with jars, bumper sub and collars and go in hole with drill pipe. Latch onto 5½" csg. at 2008'. Pick up to 100,000#, are not free. Work jars to 120,000# pipe is not cut. Release overshot and trip out of hole with drill pipe, collars and bumper sub, jars and overshot. Pick up shoe with washpipe on collars and go in hole with drill pipe. Go over 5½" stub at 2008' and run shoe to 2024'. Trip out with drill pipe, collars, washpipe, and s. Pick up 4 5/8" mill on 5½" inside cutter on collars and go in hole with drill pipe. Go into 5½" csg. at 2008' and cut 5½" csg. at 2024'. Trip out of hole with drill pipe, collar and inside cutter. Pick up overshot with jars, bumper sub and collars and go in hole with drill pipe. Latch onto fish at 2008'. Pick up to 100,000#, are not free. Work jars to 120,000#, pipe is not cut. Trip out with drill pipe, collar bumper sub, jars and overshot. 3½" hours waiting on 5½" inside cutter.

- 4-7) Trip out of hole with fish from 2030', 15 1/2 hours waiting on inside cutter. Pick up 5 1/2" cutter with 4 5/8" mill guide on 3 1/2 collars and go in hole with 2 7/8" drill pipe. Pick up Kelly and cut 5 1/2" csg. at 2030'. Trip out of hole with drill pipe, collars and cutter with mill. Pick up overshoot with jars, bumper sub with collar and accelerator sub. Go in hole with drill pipe. Latch onto 5 1/2" csg. at 2008'. Pull to 80,000 lbs. comes free. Start out of hole with drill pipe, 5 1/2" csg. is dragging with junk.
- 5-7) Milling on 5 1/2" csg. with flatbottom mill at 2035' this a.m. Finish trip out of hole with drill pipe, collars, bumper sub, jars and overshoot. Recover 20', 5 1/2" csg. with csg. collar on bottom. (Did not recover any junk. Have indication of cement on stub of joint below collar on 5 1/2" csg.) Pick up shoe with washpipe on drill collars and go in hole with drill pipe. Tag top cement at 2028', tag top 5 1/2" csg. stub at 2030', start washing over 5 1/2" csg. at 2030', wash to 2034', start torqueing and hanging up. Trip out of hole with drill pipe, collars, washpipe and shoe. Pick up overshoot with jars, bumper sub, collars and go in hole with drill pipe. Tag top 5 1/2" csg. at 2030'. Pick up with slight drag. Trip out of hole with drill pipe, collars, bumper sub, jars and overshoot. Have no recovery in overshoot. Have pulled off junk. Pick up tapered box tap with jars, bumper sub and collar. Go in hole with drill pipe. Tag on 5 1/2" csg. at 2030' tapered box. Tap will not go over fish. Range of taper, 6" to 4 1/2". Trip out of hole with drill pipe, collars, bumper sub, jars and tapered box tap. No interior scars on box tap, have scars on cut lip guide. Pick 8 1/2" flat bottom mill on drill collars and go in hole with drill pipe. Pick up Kelly and tag 5 1/2" csg. at 2030'. Make 5' in 6 hours to 2035'.

# SALTVILLE UNDERGROUND STORAGE CO.

CH-16

- 2-6-79 Trip out of hole with magnet this a.m. at 2036'. Mill to 2036', make 1' in two hours. Mill worn out. Start out of hole with drill pipe, drags for 2 stds and comes free. Pull total of 5 stds. Drill pipe, fan on, unit motor goes through radiator. Down 12 hours unit repair. Finish trip out of hole with drill pipe, collars and mill. Pick up 8½" magnet and go in hole with collars and drill pipe. Trip out with drill pipe, collars and magnet. Recover coarse iron cuttings. Make 1 more run with magnet.
- 2-7-79 Washing over at 2056' this a.m. Made 20'. Finish trip out with magnet, recover iron filings. Build poor boy basket. (4' of 7" csg. welded around bottom of jt. of 4" drill pipe.) Pick up mill with basket. Go in hole with drill pipe. Tag top 5½" csg. at 2036'. Pick up kelly and rotate and circulate on 5½" csg. stub. Trip out of hole with drill pipe, with basket and mill. Recover iron filings with small bits of broken shoes. Pick up shoe with washpipe with collars with basket and go in hole with drill pipe. Tag top 5½" csg. at 2036'. Pick up kelly and start washing over 5½" csg. at 2036' washover, to 2056' in 10 hours. Passed 5½" csg. collar at 2048'. Having fuel problems on engine of unit.
- 2-8-79 Down working on engine on unit at 2056', 2 hours washing over. 8 hours trip out of hole with drill pipe, basket, collars, washpipe, and shoe. Shoe worn out and basket full of iron filings. 14 hours down, rig repair.
- 2-9-79 Down working on engine on unit at 2056'.
- 2-10-79 Down working on engine on unit at 2056'.
- 2-11-79 Down working on engine on unit at 2056'.
- 2-12-79 Milling on 5½" csg. at 2054' this a.m. 3 hours down on engine. Pick up new shoe at 11:00 a.m. 2-11-79. Pick up shoe with washpipe with collars, basket and go in hole with drill pipe. Tag top 5½" csg. at 2039'. Go over and start washing over 5½" csg. at 2056'. Shoe starts torqueing on junk. Trip out of hole with drill pipe, collars, washpipe and shoe. Shoe is broken. Pick up overshot with jars, bumper sub and collars. Go in hole with drill pipe. Tag 5½" csg. at 2039'. Latch on to 5½" csg. and pick up with no weight increase. Trip out with drill pipe, collars, bumper sub, jars and overshot. Recover 14½", 5½" csg. with ¼ of jt. milled away by shoe. Have thread on bottom end. Pick 8½" flat bottom mill with collars and basket. Go in hole with drill pipe. Tag top junk at 2046' milling on junk to 2054'. Mill 8' junk in 8 hours.

# SALTVILLE UNDERGROUND STORAGE CO.

CH-16

- 2-13-79 Trip out with overshot at 2073' this a.m. Made 17' mill from 2054' to 2055'. Mill worn out, trip out of hole with drill pipe, basket, collars and mill. Mill worn on O.D. and bottom. Pick up shoe with washpipe, collars and basket. Go in hole with drill pipe. Tag 5½" csg. at 2055', washover to 2062'. Shoe worn out. Trip out of hole with drill pipe, basket, collars, washpipe, and shoe. Shoe worn but not broken. Pick up shoe with washpipe, collars, basket and go in hole with drill pipe. Tag 5½" csg. and go over at 2055' and tag up at 2062'. Washover from 2062' to 2072'. Shoe worn out. Trip out of hole with drill pipe, basket, collars, washpipe and shoe. Shoe worn but not broken. Pick up overshot with jars, bumper sub and collar and go in hole with drill pipe. Tag 5½" csg. at 2055'. Go over and latch onto 5½" csg., pick 6000# above weight of string. Start out of hole with drill pipe.
- 2-14-79 Trip out with shoe this a.m. at 2073'. Finish trip out of hole with drill pipe, collars, bumper sub, jars and overshot. Recover 5' slab of 5½" csg. with 3' of 5½" with washed upper part with full I.D. bottom, bottom cut with inside cutter. Pick up overshot with jars, bumper sub and collars and go in hole with drill pipe. Tag top fish at 2062'. Pick up with no increase in string weight. Trip out of hole with drill pipe, collars, bumper sub, jars, and overshot. Recover 13' of 5½" csg. split with shoe. Pick up overshot with jars, bumper sub, collars and go in hole with drill pipe. Tag 5½" csg. at 2073'. Unable to go over 5½" csg. with overshot. Trip out of hole with drill pipe, collars, bumper sub, jars and overshot. Have no recovery in overshot. Pick up 8 3/8" flat bottom mill with collars and basket. Go in hole with drill pipe. Tag top fish at 2062', 11' high to 5½" at 2073'. Mill on fish for 1 hour are spinning and driving fish. Increase weight to 8000# with no torque. Push fish to 2067'. Trip out of hole with drill pipe, basket, collars and flat bottom mill. Have scar in center of mill. Have junk in hole sticking up from I.D. of 5½" csg. at 2073' at 2067'. Pick up shoe with washpipe, collars and basket and go in hole with drill pipe. Tag fish. Start washing over fish, wash to 2073', make 2' in 3½ hours.
- 2-15-79 Have caught and tagged 5½" csg. this a.m. at 3102'. Trip out of hole with drill pipe, basket, collars and shoe. Shoe worn and broken. Pick up 8 3/8" O.D. bladed bottom mill with drill collar and basket. Go in hole with drill pipe. Tag top 5½" csg. at 2070'. Start milling on 5½" csg., mill to 2086' carrying 8000# weight, weight falls back to 2000# to 2089' and falls free. Trip out of hole with drill pipe, basket, collars and mill. Lay down basket and go in hole with mill, 2 stds. collars and drill pipe. Pick up 30 jts. drill pipe and tag up on fish at 3102'.

- 2-16-79 Waiting on drill pipe and circulating hole at 3636' this a.m. Pick up kelly and mill with 1000# to 2000# weight to 3157' falls free. Run to 3597' out of drill pipe. Pick up kelly and run to 3636' and start circulating hole at 1:30 p.m. 2-15-79. Waiting on drill pipe, 18 hours waiting on drill pipe.
- 2-17-79 Lay down kelly and pick up drill pipe. Tag fish at 3657'. Pick up kelly and start milling on fish. Circulate and mill for 3 hours. Unable to make any penetration. Trip out of hole with drill pipe, collars, and mill. Pick up overshot with jars, bumper sub, collars and accelerator sub. Go in hole with drill pipe, tag fish at 3657'. Latch onto fish, have torque but no additional weight. Trip out of hole with drill pipe, accelerator sub, collars, bumper sub, jars and overshot. Recover 3 chunks of dolomit. (1) 7" X 6" X 4" (2) 6" X 5" X 3" (3) 5" X 3 1/2" X 3" approximate weight 10#. Go in hole with 3 1/2" collars and 2 7/8" drill pipe. Trip out of hole with laying down 2 7/8" drill pipe and 3 1/2" collars.
- 2-18-79 Going in hole with 7 7/8" bit and 6" drill collars at 3657' this a.m. Rig McCullough wire line unit. Go in hole with collars log. Find bottom at 3630' G.L. Find bottom of 9 5/8" csg. at 3562' G.L. Run collar log from 3630' G.L. back to 1600' G. Go in hole with caliper tag bottom at 3630' G.L. and log back 3550' G.L. to 3630' G.L. in excess of 16", caliper wide open. 12 hours waiting on 7 7/8" bit and 6" drill collars. Pick up 7 7/8" Hughes J4 bit with 5-6" collars.
- 2-19-79 Drilling and re-drilling from 3642' to 3663' this a.m. Finish picking up bit with total of 10-6" collars with 4-5 1/2" collars and go in hole with 4" drill pipe, tag bottom at 3642'. Pick up kelly and start drilling at 3642'. Drill kelly down to 3663'. Pick up and set down at 3642'. 18 hours drilling and re-drilling hole from 3642' to 3663'.

clt

SALTVILLE UNDERGROUND STORAGE CO.

Well CH-16

2-20-79 Drilling and washing hole at 3726' this A.M.

Clear spot at 3663' and run to 3687'. Wash and drill through spot from 3687' to 3695'. Make connection and wash and drill to 3708'. Are sticking at 3687' to 3695'. Lay down 1 Jt. drill pipe and work pipe. Rotating and circulating through spot from 3687'-to 3695'. Clean up hole, make connection and run to 3717' and drill and circulate to 3726'. Rotating and circulating hole at 3726'.

2-21-79 Going in hole w/collars and pipe this A.M. at 3647'. Pick up to 3695' and stick bit, work free, start working bit through section from 3687' to 3695'. Rotate and circulate. Are circulating out salt. Water temp. 60°. Start out of hole to log at 1:00 P.M., 2-20-79. Lay down Kelly and pull 1 std. drill pipe. Run Std. back down hole and tag fill at 3687'. Pull 2 stds. drill pipe. Are back into 9 5/8" csg. w/bit. w/no drag. Trip out of hole w/drill pipe, collars and bit. Rig Basin Surveys. Wire line. Wait and go in hole w/bailer tag bottom at 3647'. Run Newtron-Gamma Ray and Collor Log from 3640' back to 2000'. Rig Dowell Sonar Caliper Log and Evaluate Cavern from 3647' to 3562'. Go in hole w/drill collars and pipe.

2-22-79 Rigging down this A.M. Trip out of hole laying down drill pipe and collars.

VIRGINIA GAS COMPANY

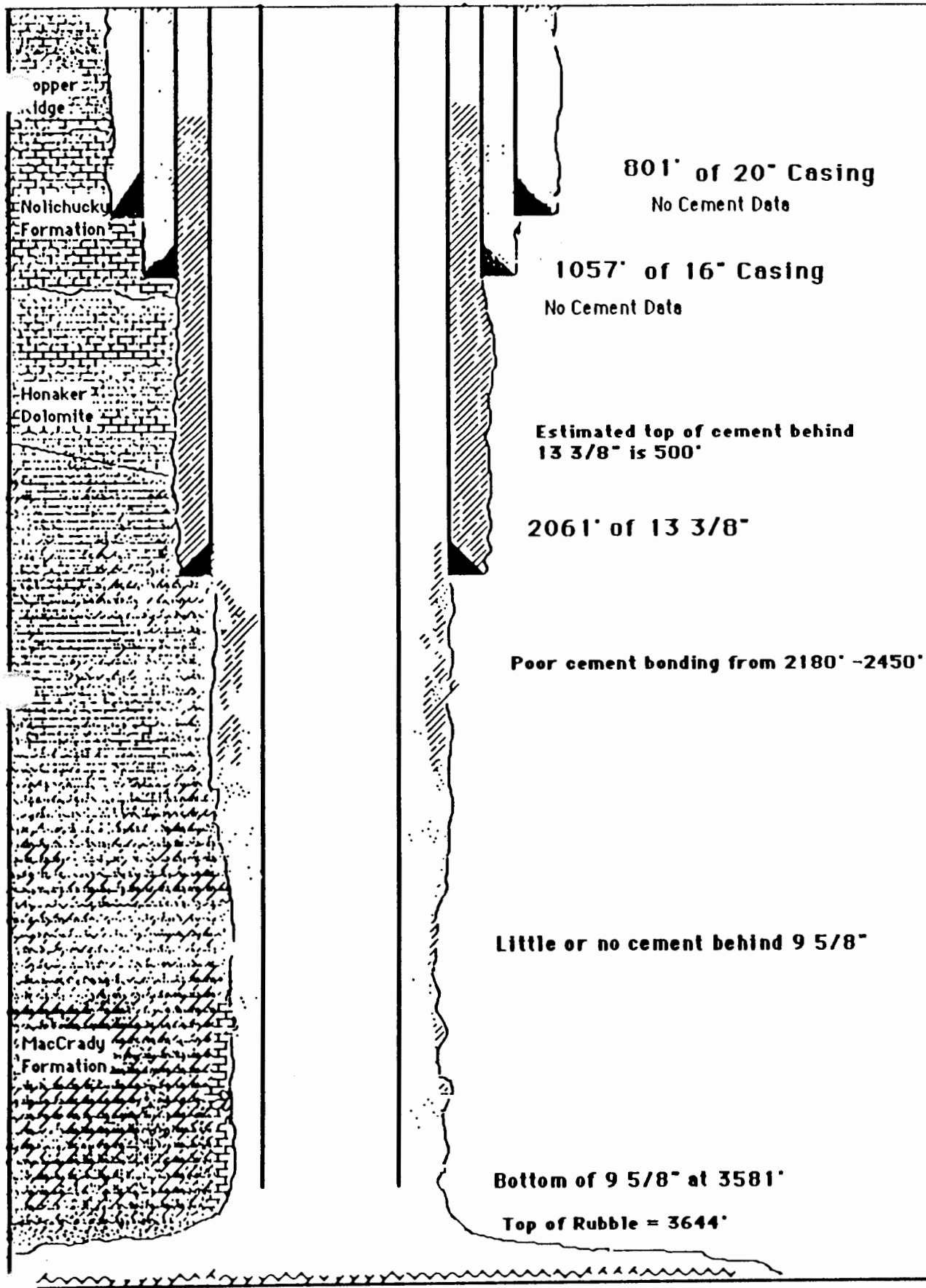
CH-16  
RE-ENTRY PROGRAM

## CH - 16 Cementing Procedure

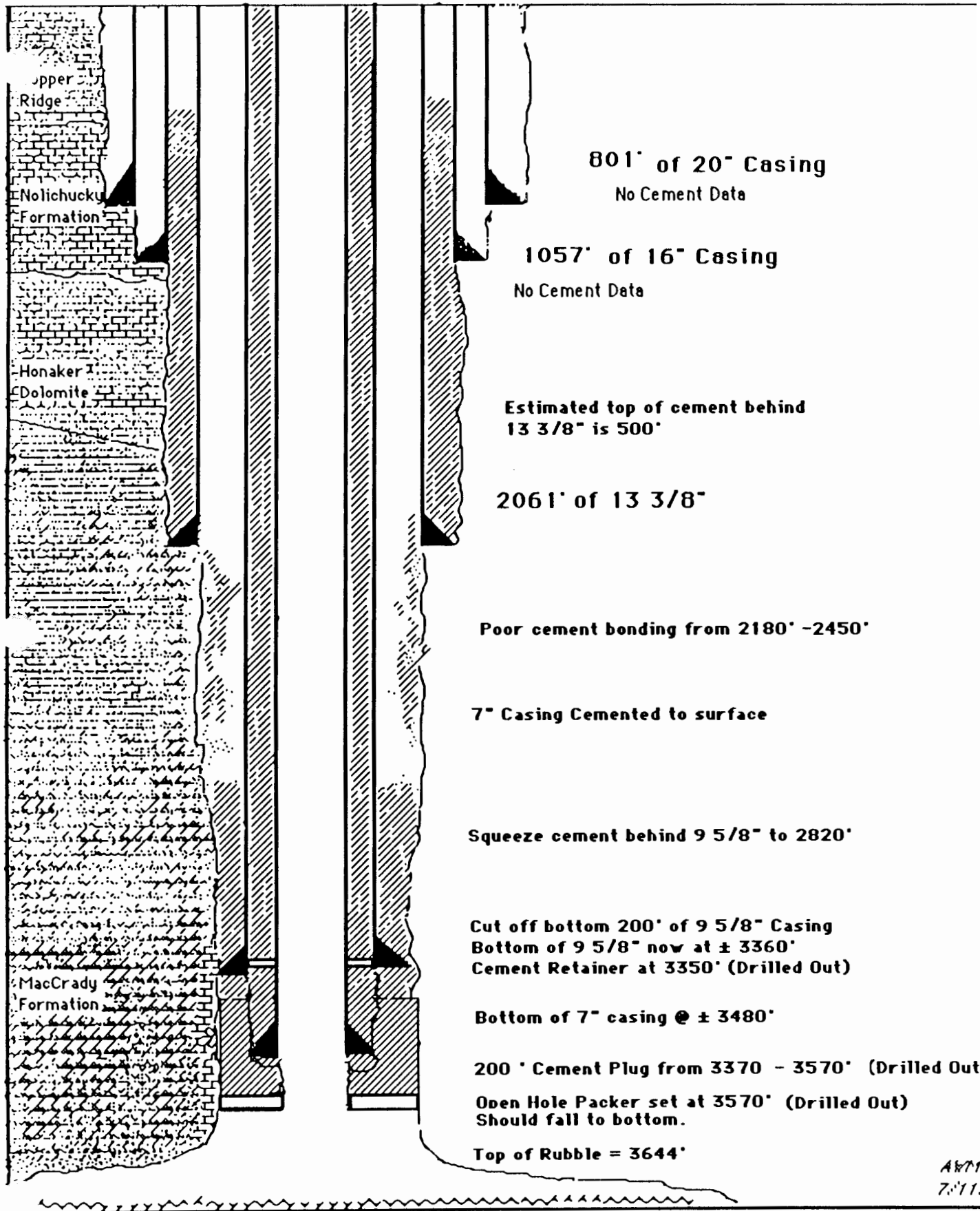
1. Move in- Rig Up Union Drilling's Rig 15 on the CH - 16 Well; Rig Down and release Well Tech Rig 290 on the CH - 20 Well.
2. RIH w/ 9 5/8" Casing Cutters on 3 1/2" IF drill pipe. Bottom of 9 5/8" @ 3581'; Cut off 9 5/8", 43.5# casing at: 3540'; 3512'; 3474'; 3434'; 3400'; and 3360'. Let casing fall into cavern. If casing does not drop down, extend cutter slips out again and set down with drill pipe, forcing casing out into cavern; Continue until 221' of borehole is exposed.
3. RU Loggers; Run caliper log across open hole section from 3581' to bottom of 9 5/8" to determine best place to set packer and to calculate cement volumes to fillup to 3380' (200' cement plug).
4. Run Baker Open Hole Inflatable Packer to  $\pm$  3570' and set; Dump 10' of sand on top of packer; Run drillpipe open-ended to top of packer and pump water spacer and cement. TOOH w/ DP. WOC 12 hrs.
5. Squeeze 9 5/8"; RIH w/ wireline; check TOC; Perforate 9 5/8" w/3 Holes at 2820'; RIH w/ drill pipe and packer; set 9 5/8" packer at 2900'; RU pump truck; do injection test to determine if hole will circulate. If hole circulates; TOOH with drill pipe, RIH w/wireline cement retainer; set retainer in bottom of 9 5/8" @  $\pm$ 3350'; RU cement company to pump \_\_\_\_sacks of a salt-based cement system and squeeze behind 9 5/8". TOOH with drill pipe, reverse circulate cement off of top of liner; WOC .
6. **Move rig to CH - 20;** and complete plugging procedure before continuing on with the CH - 16.
7. Wait 48 - 72 Hrs after squeezing before running CBL on 9 5/8"; if additional cement fillup is needed; re-squeeze at this time. Haul in 7" casing.
8. Move Rig 15 back onto site and rig up; RIH w/ 8 3/4" bit and drill up cement retainer and drill out cement to  $\pm$  3500'. Run 7" casing to  $\pm$  3480'; cement back to surface.
9. Run CBL to verify cement fillup/bond.
10. RIH w/ 6 1/4" bit and drill out 7" shoe and  $\pm$  100' of cement plug to top of Baker packer; TOOH with bit; RIH w/ 6 1/4" burn shoe to drill up inflatable packer at  $\pm$  3570' and let fall into cavern;
11. TOOH w/ burn shoe; TIH w/ 6 1/4" bit and drill into rubble pile. Top of rubble @ 3644'.
12. Drill as deep as possible; bottom of cavern at 4015'.
13. Run 4 1/2 " debrining string and hang.

AWM 7/11/95

# CII - 16 Well Schematic Prior to Cementing



# CH - 16 Well Schematic After Completion



Date: 3/28/95

Grade and ditch road to site; begin site work.

Date: 3/30/95

Well: CH-16 Reentry

**Contractor: W-L Construction**

Rig: \_\_\_\_\_

County: Washington

District: \_\_\_\_\_

**State:** Virginia

**Activity:** Site construction

**Depth:** \_\_\_\_\_

**24 hr. footage:**

**CSG/TBG:**

**Deviations:**

Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

### Break Down (Hours)

### Activity

**3/29/95**

### Site construction.

Date: 3/31/95

Well: CH-16 Reentry

**Contractor: W-L Construction**

Rig: \_\_\_\_\_

County: Washington

District:

State: Virginia

Activity: Site construction

**Depth:** \_\_\_\_\_

24 hr. footage: \_\_\_\_\_

**CSG/TBG:**

**Deviations:**

Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

### Break Down (Hours)

### Activity

**3/30/95**

**Site construction.**

Date: 4/3/95

Well: CH-16 Reentry

**Contractor: W-L Construction**

**Rig:**

County: Washington

District:

**State:** Virginia

Activity: Site construction

**Depth:**

**24 hr. footage:**

**CSG/TBG:**

**Deviations:**

Bit:	Size:	Type:
------	-------	-------

**Cum footage:**

Cum. Hours:

### Break Down (Hours)

### Activity

3/31/95

Site construction; clear out and grade back part of site road construction; install culverts, grade berm.

Date: 4/4/95

Well: CH-16 Reentry

**Contractor: W-L Construction**

Rig: \_\_\_\_\_

County: Washington

District: \_\_\_\_\_

State: Virginia

**Activity:** Site and road construction

Depth: \_\_\_\_\_

24 hr. footage: \_\_\_\_\_

**CSG/TBG:**

**Deviations:**

Bit:	Size:	Type:
------	-------	-------

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

### Break Down (Hours)

### Activity

4/3/95

Construct road and site to final grade; prepare to spread gravel.



VIRGINIA GAS COMPANY  
Daily Drilling and Completion Report

Date: 4/6/95

Rig Day: \_\_\_\_\_

Well: CH-16 Reentry

Contractor: W-L Construction

Rig: \_\_\_\_\_

County: Washington

District: \_\_\_\_\_

State: Virginia

Activity: Site and road construction

Depth: \_\_\_\_\_

24 hr. footage: \_\_\_\_\_

CSG/TBG: \_\_\_\_\_

Deviations: \_\_\_\_\_

Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

Break Down  
(Hours)

Activity

4/5/95

Gravel road and site.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Date: 4/7/95

Cell: CH-16 Reentry

**Contractor: W-L Construction**

Rig: \_\_\_\_\_

**County:** Washington

District: \_\_\_\_\_

**State:** Virginia

**Activity:** Site and road construction

Depth: \_\_\_\_\_

**24 hr. footage:** \_\_\_\_\_

**CSG/TBG:**

**Deviations:**

Blt: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

### Break Down (Hours)

### Activity

**4/6/95**

### Road and site construction.

VIRGINIA GAS COMPANY  
Daily Drilling and Completion Report

Date: 4/14/95

Rig Day: \_\_\_\_\_

Well: CH-16 Reentry

Contractor: W-L Construction

Rig: \_\_\_\_\_

County: Washington

District: \_\_\_\_\_

State: Virginia

Activity: Site and road construction

Depth: \_\_\_\_\_

24 hr. footage: \_\_\_\_\_

CSG/TBG: \_\_\_\_\_

Deviations: \_\_\_\_\_

Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

Break Down  
(Hours)

Activity

4/11/95

Site work; excavator with rock chisel to cut out rock and widened site.

4/12/95

Cut out highwall to obtain site width.

4/13/95

Finish cutting out highwall.

Date: 4/19/95

Well: CH-16 Reentry

**Contractor:** W-L Construction

**Rig:** \_\_\_\_\_

**County:** Washington

**District:** \_\_\_\_\_

State: Virginia

**Activity:** Reclamation; Moving in Equipment

Depth: \_\_\_\_\_

24 hr. footage: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

### Activity

4/14/95

**Install entrance gate and posts.**

**4/17/95**

**Hydroseed road and site.**

**4/18/95**

Hot tap CH-16 well; Pressure = 100 psi, open up valve, recover 1/2 gal. diesel fuel; Pressure = 0 psi; TOC is above 9 5/8" casing; Begin moving in water tanks; Hot tap CH-20 well; Pressure = 0 psi.


Date: 4/24/95

Call: CH-16 Reentry

**Contractor: W-L Construction**

Rig: \_\_\_\_\_

**County:** Washington

District: \_\_\_\_\_

**State:** Virginia

**Activity:** Moving in Equipment

**Depth:** \_\_\_\_\_

**24 hr. footage:** \_\_\_\_\_

**CSG/TBG:**

**Deviations:**

Blit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_

**Cum footage:** \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

### Break Down (Hours)

### Activity

**4/19/95**

## Move in water tanks; pipe racks

**4/20/95**

## Move in water tanks

**4/21/95**

Move in steel mud pit and last water tank; haul in water; move in dozer, service rig and auxillary drilling equipment

VIRGINIA GAS COMPANY  
Daily Drilling and Completion Report

Date: 4/25/95

Rig Day: 1

Well: CH-16 Reentry

Contractor: Well Tech

Rig: 290

County: Washington

District: \_\_\_\_\_

State: Virginia

Activity: Drilling out top cement plug

Depth: 10'

24 hr. footage: \_\_\_\_\_

CSG/TBG: \_\_\_\_\_

Deviations: \_\_\_\_\_

Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

Break Down  
(Hours)

Activity

4/24/95

Haul in 2 7/8" tubing for drill pipe and unload; rig up service rig and power swivel truck;  
install workover wellhead and BOP's; begin drilling out top plug @ 1430 hrs; make 10' in.  
3.5 hrs.

Date: 4/26/95

Completed drilling out top cement plug; bottom of plug at 105'; shut down to repair packing on swivel.

Date: 4/27/95

## CH-16 Reentry

Rig: 290

**State:** Virginia

**24 hr. footage:**

**Deviations:**

**Cum. Hours:** \_\_\_\_\_

### Activity

**4/26/95**

Strip in hole w/8 1/2" bit, drilling sub w/float, 2-6" drill collars, and  
changeover sub. Start circulating down, drilling out small stringers of cement  
from 150'-450'. Continue tripping in hole to 1710' to top of second cement plug.  
Drill soft cement (2'/min.) to 1750'. Drill hard cement (1 1/2 min.) to 1827'.  
Bridge plug depth estimated at 1900'.

**VIRGINIA GAS COMPANY**  
**Daily Drilling and Completion Report**

Date: 4/28/95

Rig Day: 4

Well: CH-16 Reentry Contractor: Well Tech, Inc. Rig: 290  
 County: Washington District: \_\_\_\_\_ State: Virginia  
 Activity: Flowing back cavern Depth: 1900' 24 hr. footage: \_\_\_\_\_  
 CSG/TBG: \_\_\_\_\_  
 Deviations: \_\_\_\_\_  
 Bit: \_\_\_\_\_ Size: 8 1/2" Type: \_\_\_\_\_ Cum footage: \_\_\_\_\_ Cum. Hours: \_\_\_\_\_

**Break Down  
(Hours)**

**Activity**

4/27/95	Drill hard cement from 1827' - 1842'; drill soft cement from 1842' - 1900';
	begin drilling on bridge plug at 0945 hrs. with 7000# bit weight. 1030 hrs; made 4",
	shutdown, check flow rate - none. Resume drilling on plug. 1200 hrs., increase bit
	weight to 10,000#, made 18". 13:15 hrs., bridge plug lets loose forcing drill string up
	20 ft. into derrick; shut BOP's; 13:30 hrs., 15 minute pressure buildup to 805 psig; begin
	flowing gel water in casing back into mud tank. 14:15 hrs., recover 96 bbl gel water;
	pressure = 685 psig.; shut-in flow line, hookup to flowback tanks. 14:30 hrs.; pressure =
	715 psig., begin flowback to tanks at 2.3 bpm. 15:30 hrs.; pressure = 560 psig., total fluid
	recovered = 236 bbls; 16:30 hrs; pressure = 530 psig.; total fluid recovered = 371
	bbls. 17:30 hrs.; pressure = 515 psig.; total fluid recovered = 476 bbls. 17:45 hrs., pressure
	drops to 0 psig; differential pressure causes salt plugging around bridge plug; SIW; build
	pressure. 18:05 hrs.; pressure = 575 psig; begin flowing to tanks at slow rate. 20:00 hrs.;
	pressure = 540 psig, total fluid recovered = 546 bbls. 24:00 hrs; pressure = 480 psig,
	total fluid recovered = 736 bbls.

**Date: 4/29/95**

Well: CH-16 Reentry

**Contractor: Well Tech, Inc.**

Rig: 290

**County:** Washington

District:

**State:** Virginia

Activity: Flowing back cavern

**Depth: 1900'**

**24 hr. footage:**

**CSG/TBG:**

**Deviations:**

Bit:                      Size: 8 1/2"    Type:

**Cum footage:**

Cum. Hours:

### Break Down (Hours)

## Activity

4/28/95

### Flowing back cavern

04:00 hrs; Pressure = 440 psig; fluid recovered = 962 bbls

08:00 hrs; Pressure = 420 psig; fluid recovered = 1032 bbls

11:00 hrs.; salt buildup around CIBP reducing flow. Pump 2 bbl fresh water down drill stri

11:45 hrs.; SIP = 440 psig; fluid recovered = 1050 bbls

16:00 hrs.; SIP = 410 psig; fluid recovered = 1240 bbls

20:00 hrs.; SIP = 375 psig; fluid recovered = 1480 bbls

24:00 hrs.; flowing pressure = 290 psig; fluid recovered = 1644 bbls

VIRGINIA GAS COMPANY  
Daily Drilling and Completion Report

Date: 4/30/95

Rig Day: 6

Well: CH-16 Reentry Contractor: Well Tech, Inc. Rig: 290  
County: Washington District: \_\_\_\_\_ State: Virginia  
Activity: Flowing back cavern Depth: 1900' 24 hr. footage: \_\_\_\_\_  
CSG/TBG: \_\_\_\_\_  
Deviations: \_\_\_\_\_  
Bit: \_\_\_\_\_ Size: 8 1/2" Type: \_\_\_\_\_ Cum footage: \_\_\_\_\_ Cum. Hours: \_\_\_\_\_

Break Down  
(Hours)

Activity

4/29/95	03:00 hrs; Recovered = 1709 bbls; SIWP= 285 psig
	09:00 hrs; Recovered = 1791 bbls; SIWP= 280 psig
	14:00 hrs; Recovered = 1909 bbls; SIWP= 250 psig
	18:00 hrs; Recovered = 2100 bbls; SIWP= 215 psig
	19:30 hrs; Recovered = 2275 bbls; SIWP= 170 psig
	21:30 hrs; Recovered = 2572 bbls; SIWP= 110 psig
	23:30 hrs; Recovered = 2817 bbls; SIWP= 60 psig
4/30/95	01:30 hrs; Recovered = 3064 bbls; SIWP= 50 psig
	Shut down till daylight to move in additional tank

Date: 5/1/95

Well: CH-16 Reentry

Rig: 290

**County:** Washington

District: \_\_\_\_\_

**State:** Virginia

**Activity:** Flowing back cavern

**Depth: 1900'**

24 hr. footage: \_\_\_\_\_

**CSG/TBG:**

**Deviations:**

**Blit:**                      **Size:** 8 1/2"    **Type:**

**Cum footage:** \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

### Break Down (Hours)

### Activity

4/30/95

08:00 hrs; Unload additional tanks from UDI and WTI

09:00 hrs; Resume flowback; SIWP= 50 psig

10:00 hrs; Recovered = 3162 bbls; SIWP= 40 psig

12:00 hrs; Recovered = 3270 bbls; SIWP= 20 psig

14:00 hrs; Recovered = 3308 bbls;

20:00 hrs; Recovered = 3330 bbls; SIWP= 0 psig

Pulled up drill string and removed top joint

VIRGINIA GAS COMPANY  
Daily Drilling and Completion Report  
Date: 5/2/95

Rig Day: 8

II: CH-16 Reentry

Contractor: Well Tech, Inc.

Rig: 290

County: Washington

District: \_\_\_\_\_

State: Virginia

Activity: Completed drilling out bridge plug

Depth: 3593'

24 hr. footage: \_\_\_\_\_

CSG/TBG: \_\_\_\_\_

Deviations: \_\_\_\_\_

Bit: \_\_\_\_\_ Size: 8 1/2" Type: \_\_\_\_\_

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

Break Down  
(Hours)

Activity

5/1/95

08:00 hrs; Recovered 3340 bbls fluid, made 10 bbls overnight. Resume drilling on bridge plug; well begins to flow. Shut down; order extra tank from UDI.

11:00 hrs; Recovered 3484 bbls fluid; flow stopped; resume drilling on plug.

13:05 hrs; Bottom slips on plug drilled off, plug goes down hole. Begin running drill pipe to bottom; low flow rate.

16:00 hrs; Recovered 3512 bbls fluid; ran 3593' of drill string; bottom of 9 5/8" @ 3581'; pushed bridge plug out bottom.

16:15 hrs; TOOH w/ drill pipe; ready to run junk basket in morning.

Date: 5/3/95

: CH-16 Reentry Contractor: Well Tech, Inc. Rig: 290  
 County: Washington District: \_\_\_\_\_ State: Virginia  
 Activity: Ready to log Depth: 3656' 24 hr. footage: \_\_\_\_\_  
 CSG/TBG: \_\_\_\_\_  
 Deviations: \_\_\_\_\_  
 Bit: Junk Size: 3 1/2" Type: \_\_\_\_\_ Cum footage: \_\_\_\_\_ Cum. Hours: \_\_\_\_\_  
Break Down  
(Hours) Activity  
5/2/95 07:00 hrs; open well to tank; well flows 40 bbls.  
08:30 hrs; flow ceases; total fluid recovered = 3552 bbls; strip off B.O.P.'s; pull  
collars and bit out of hole.  
10:35 hrs; TIH w/tubing and junk basket.  
11:55 hrs; tag top of rubble pile at 3656' and setdown at 3665'.  
12:15 hrs; pick up 2' off bottom, circulate 5bbl fluid.  
13:00 hrs; TOOH w/tubing and junk basket.  
15:00 hrs; recover junk basket w/ dolomite flakes, salt grains, and metal cuttings, EMI  
took sample of fluid for testing.  
16:00 hrs; shut down, ready to log 5/4/95.

Date: 5/5/95

Call: CH-16 Reentry

**Contractor: Well Tech, Inc.**

Rig: 290

County: Washington

District:

**State:** Virginia

**Activity:** Ready to log

**Depth: 3656'**

24 hr. footage: \_\_\_\_\_

**CSG/TBG:**

**Deviations:**

Bit:	Size:	Type:
------	-------	-------

**Cum footage:** \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

### Break Down (Hours)

### Activity

**5/3/95**

**Ready to log**

5/4/95

Logging rescheduled for 5/5/95 - 5/6/95; received fluid analysis for sample taken 4/28/95 by EMI; data is as follows:

Chlorides > 300,000 ppm

Mercury	0.0004 ppm
---------	------------

pH 9.6

Sp. Gr. 1.20

TDS	> 220,000 ppm
-----	---------------

VIRGINIA GAS COMPANY  
Daily Drilling and Completion Report

Date: 5/6/95

Rig Day: 11

Well: CH-16 Reentry

Contractor: Well Tech, Inc.

Rig: 290

County: Washington

District: \_\_\_\_\_

State: Virginia

Activity: \_\_\_\_\_

Depth: 3656'

24 hr. footage: \_\_\_\_\_

CSG/TBG: \_\_\_\_\_

Deviations: \_\_\_\_\_

Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

Break Down  
(Hours)

Activity

5/4/95	Open up well at 1800 hrs; well flows 80 bbls at 0 psig
	Total fluid recovery = 3632
5/5/95	0700 hrs; open up well; well flows 60 bbls at 0 psig
	Total fluid recovery = 3692 bbls
	0830 hrs; RU Atlas Wireline; run 8 1/2' gauge ring to 3568'; casing clear
	1030 hrs; Run casing inspection log; field interpretation shows only minor pitting/corrosion on 9 5/8" string
	1400 hrs; Run GR/NEU/CCL base log
	1700 hrs; run GR/CBL log; bond log indicates:
	0' - 120' - Good cement
	120' - 1620' - No cement
	1620' - 1990' - Poor cement; $\pm$ 60% bonding
	1990' - 2250' - No cement
	2250' - 3581' - Highly variable with fill debris around pipe
	2100 hrs; CBL complete; shut in well for evening

Date: 5/7/95

File: CH-16 Reentry

Rig: 290

State: Virginia

24 hr. footage: \_\_\_\_\_

Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_ Cum footage: \_\_\_\_\_ Cum. Hours: \_\_\_\_\_

## Activity

1600 hrs; RD; SIW

**VIRGINIA GAS COMPANY**  
**Daily Drilling and Completion Report**

Date: 7/19/95

Rig Day: 1

Well: CH-16 Reentry (Phase 2)

Contractor: Union Drilling

Rig: 15

County: Washington

AFE: 108

State: Virginia

Activity: MIRU; Ready to cut off 9 5/8"

Depth: 3668'

24 hr. footage:         

CSG/TBG:                                 

Deviations:                                 

Bit:          Size:                  Type:                 

Cum footage:                 

Cum. Hours:                 

Break Down  
(Hours)

Activity

7/13/95  
7/14/95  
7/17/95  
7/18/95  
Hours  
1.50  
0.50  
2.00  
1.50  
0.50  
8.00  
          
          
          
        

Begin moving in rig.  
Finish moving in.  
Set up rig.  
                                  
                                  
Drill rathole  
Open up well; recover 44 bbl brine  
Weld 13 3/8" nipple onto BOP flange  
Nipple up  
Rig service  
Pick up and RIH w/9 5/8" casing cutters, 10 drill collars, and 3200' of drill pipe;  
Shut down at 2100 hrs.

**VIRGINIA GAS COMPANY**  
**Daily Drilling and Completion Report**

Date: 7/20/95

Rig Day: 2

Well: CH-16 Reentry (Phase 2) Contractor: Union Drilling Rig: 15  
 County: Washington AFE: 108 State: Virginia  
 Activity: Cutting off 9 5/8" casing Depth: 3462' 24 hr. footage: \_\_\_\_\_  
 CSG/TBG: \_\_\_\_\_  
 Deviations: \_\_\_\_\_  
 Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_ Cum footage: \_\_\_\_\_ Cum. Hours: \_\_\_\_\_

**Break Down  
 (Hours)  
 7/19/95**

**Activity**

0700	RU; start cut at 3540'; cut completed but casing will not fall; apply 16,000# weight; still will not go downhole.
0800	Make cuts at 3560', then at 3570'; apply weight; casing still will not drop.
0940	TOOH w/ cutters and DP.
1240	Cutter out; knives appear they did not cut all the way through; casing may be slightly egg-shaped; modify cutter for maximum knife extension and replace cutter knives.
1400	RIH w/ casing cutter and DP.
1630	Make cut at 3538'; casing falls free.
1710	Make cut at 3502'; casing falls free.
1750	Make cut at 3462'; casing falls free.
1835	Pull up to 3422', try to make cut; cutter knives worn out or broken; will not cut; will have to trip out, redress tool.
1920	SIW for evening; total 9 5/8" cut off: 119'.

**VIRGINIA GAS COMPANY**  
**Daily Drilling and Completion Report**

Date: 7/21/95

Rig Day: 3

Vell: CH-16 Reentry (Phase 2)

Contractor: Union Drilling

Rig: 15

County: Washington

AFE: 108

State: Virginia

Activity: Cutting off 9 5/8" casing

Depth: 3422'

24 hr. footage:         

CSG/TBG:                         

Deviations:                         

Bit:          Size:                  Type:                 

Cum footage:                 

Cum. Hours:                 

Break Down  
(Hours)

Activity

<del>750</del> 95	
0700	RIH; check wellbore to 3570'; wellbore clear, no casing.
0830	TOOH w/ cutter and inspect.
1000	Redress cutter w/new knives.
1030	RIH w/redressed cutter.
1300	Cut casing at 3425', 3382', and 3360'; casing does not fall.
1500	Make cut at 3440', casing falls free.
1600	Make cut at 3430' casing falls free.
1630	Move cutter up 5' to 3425, no casing.
1645	Move cutter back to 3422'; no casing' both pieces fell free.
1700	Move cutter to 3400', make cut; casing does not fall.
1730	Move cutter to 3410', make cut; casing does not fall.
1815	Make cuts at 3414', 3418'; casing will not go downhole; even with 16,000# collar wt.; knives worn out or broken.
1915	SIW for evening; cut off 40' of 9 5/8"; total 9 5/8" cut off in two days: 159'.

VIRGINIA GAS COMPANY  
Daily Drilling and Completion Report  
Date: 7/22/95

Rig Day: 4

Well: CH-16 Reentry (Phase 2) Contractor: Union Drilling Rig: 15  
County: Washington AFE: 108 State: Virginia  
Activity: Attempting to cut off 9 5/8" Depth: 3422' 24 hr. footage: \_\_\_\_\_  
CSG/TBG: \_\_\_\_\_  
Deviations: \_\_\_\_\_  
Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_ Cum footage: \_\_\_\_\_ Cum. Hours: \_\_\_\_\_

Break Down  
(Hours)  
7/21/95

Activity

0700	RIH w/cutter down to 3570'; wellbore clear
0840	TOOH w/ cutter and DP; Inspect cutter and replace w/10 3/4" x 9 5/8" cutter.
1120	RIH w/ new cutter and DP.
1340	Make cut at 3390'; casing will not fall.
1400	Make cut at 3420'; casing will not fall free.
1450	Continue making cut at 3420' w/ 8000# weight;
	trying to jar 2' section of pipe free; will not fall.
1800	Pull up to 3414' and re-cut casing w/6000# weight; will not fall;
	casing may be spinning on collars
1840	TOOH w/cutter and DP
2000	Cutter out; inspect cutter, knives worn out; order 2 sets of jars and additional
	collars to drive casing to bottom.
2030	SIW for evening

Date: 7/23/95

Well: CH-16 Reentry (Phase 2)Rig: 15

State: Virginia

24 hr. footage: \_\_\_\_\_

Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_ Cum footage: \_\_\_\_\_ Cum. Hours: \_\_\_\_\_

## Activity

0830

1230

1400

1900

1915

---

\_\_\_\_\_

2000

2300

2400

SIW; prepare to TIH and make sure wellbore clear to TD.

Date: 7/25/95

[illegible]

Date: 7/27/95

Well: CH-16 Reentry (Phase 2)

Contractor: Union Drilling

Rig: 15

County: Washington

AFE: 108

State: Virginia

**Activity:** Wait on cement

Depth: 3552'

24 hr. footage: \_\_\_\_\_

**CSG/TBG:**

**Deviations:**

Bit:	Size:	Type:
0	1	bool
1	1	bool
2	1	bool
3	1	bool
4	1	bool
5	1	bool
6	1	bool
7	1	bool
8	1	bool
9	1	bool
10	1	bool
11	1	bool
12	1	bool
13	1	bool
14	1	bool
15	1	bool
16	1	bool
17	1	bool
18	1	bool
19	1	bool
20	1	bool
21	1	bool
22	1	bool
23	1	bool
24	1	bool
25	1	bool
26	1	bool
27	1	bool
28	1	bool
29	1	bool
30	1	bool
31	1	bool
32	1	bool
33	1	bool
34	1	bool
35	1	bool
36	1	bool
37	1	bool
38	1	bool
39	1	bool
40	1	bool
41	1	bool
42	1	bool
43	1	bool
44	1	bool
45	1	bool
46	1	bool
47	1	bool
48	1	bool
49	1	bool
50	1	bool
51	1	bool
52	1	bool
53	1	bool
54	1	bool
55	1	bool
56	1	bool
57	1	bool
58	1	bool
59	1	bool
60	1	bool
61	1	bool
62	1	bool
63	1	bool
64	1	bool
65	1	bool
66	1	bool
67	1	bool
68	1	bool
69	1	bool
70	1	bool
71	1	bool
72	1	bool
73	1	bool
74	1	bool
75	1	bool
76	1	bool
77	1	bool
78	1	bool
79	1	bool
80	1	bool
81	1	bool
82	1	bool
83	1	bool
84	1	bool
85	1	bool
86	1	bool
87	1	bool
88	1	bool
89	1	bool
90	1	bool
91	1	bool
92	1	bool
93	1	bool
94	1	bool
95	1	bool
96	1	bool
97	1	bool
98	1	bool
99	1	bool
100	1	bool
101	1	bool
102	1	bool
103	1	bool
104	1	bool
105	1	bool
106	1	bool
107	1	bool
108	1	bool
109	1	bool
110	1	bool
111	1	bool
112	1	bool
113	1	bool
114	1	bool
115	1	bool
116	1	bool
117	1	bool
118	1	bool
119	1	bool
120	1	bool
121	1	bool
122	1	bool
123	1	bool
124	1	bool
125	1	bool
126	1	bool
127	1	bool
128	1	bool
129	1	bool
130	1	bool
131	1	bool
132	1	bool
133	1	bool
134	1	bool
135	1	bool
136	1	bool
137	1	bool
138	1	bool</

Cum footage:

Cum. Hours:

## Activity

7/25/95

Idle; ready to caliper hole on 7/26/95.

7/26/95

RU HLS 4-Arm Caliper Tool.

0735

RIH w/Caliper tool would not work; TOOH; RIH w/backup tool.

1030

Caliper log completed; Btm. 9 5/8" @ 3418'; Calipered 12 1/2" to 15" from 3418' to 3574', at 3575' hole exceeds 18"

1130

RIH w/Baker Inflatable Packer on drill pipe.

1515

Packer at 3552' in 14" O.H.; RU DS and inflate packer to 2000 psi.

1620

Sting out of packer; set down w/5000# weight; packer holds.

1640

Pull 1 joint; pump 1500# 20/40 sand on top of packer, 10' of fillup to 3542'.

1745

RU DS and pump a balanced plug w/90 sks Class A, 10% Salt

--	--

Top of plug calculated at 3435'

1815

Pull up 1 1/2 stands to 3324'; reverse circulate out 2 bbl cement; cement plug in p

1900

TOOH w/ drill pipe.

2100

SIW; WOC

**WELL HISTORY CH-20**  
**Virginia File # WA-2-ST**

Operator: Olin Mathieson  
Farm: Town of Saltville  
Commence Drilling: October 28, 1959  
Complete Drilling: November 24, 1962  
Elevation: 2200'  
T.D. 3912'

CASING			
20"	@		49' 8"
16"	@		943' 1"
13 3/8"	@	2172'	11 1/4"
9 5/8"	@	3780'	2 1/4"
5 1/2"	@	3825'	9 3/4"
2 3/8"	@	3830'	8 1/4"

Interconnected with CH-16 on February 5, 1971;  
P&A by Fenix & Scisson for Olin in December, 1972.

Re-entered by MAPCO from February, 1979 to April, 1979;  
Logged March 11, 1979;  
Plugged by MAPCO June, 1981.

Started drilling Oct. 28, 1959

Completed drilling Nov. 24, 1962

Remarks	From	To	No. Ft.	Material	% Salt
	0	33	33	Yellow clay	
	33	42	9	Limestone (caving)	
	42	178	86	Limestone (hard)	
Small water seep-	128	217	89	Limestone (shelly)	
age " 217'	217	247	30	Limestone (shelly)	
Water 270-280'	247	280	33	Limestone (hard)	
	280	346	66	Limestone (black)	
	346	523	177	Limestone (hard gray)	
	523	543	20	Limestone (soft yellow)	
	543	548	5	Limestone (black and white)	
Yellow mud seam	548	628	80	Limestone (white)	
" 563'	628	637	9	Limestone (gray)	
	637	645	8	Limestone (hard gray)	
	645	665	20	Limestone with mud seams	
	665	697	32	Limestone (gray)	
	697	717	20	Limestone (black)	
	717	757	40	Limestone (gray)	
	757	827	70	Limestone (black)	
	827	837	10	Limestone (black and gray)	
	837	852	15	Limestone (hard gray)	
	852	875	23	Limestone (hard gray and white)	
	875	885	10	Limestone (black and gray)	
	885	890	5	Limestone (gray)	
	890	896	6	Limestone with mud seams	
	896	928	32	Limestone and Red Shale	
	928	937	9	Gypsum and Red and Gray Shale	
16" casing set-	937	959	22	Red and Gray Shale	
up 943' 1"	959	975	16	Gray Shale	
9/12/60	975	985	10	Red and Gray Shale	
	985	1060	75	Gray Shale	
	1060	1220	160	Red and Gray Shale	
	1220	1240	20	Gray Shale	
	1240	1262	22	Red and Gray Shale	
	1262	1278	16	Gray Shale and Salt	20%
	1278	1289	11	" " " "	50%
	1289	1299	10	" " " "	80%
	1299	1332	33	" " " "	10%
	1332	1340	8	" " " "	30%
	1340	1347	7	Gray Shale	
	1347	1364	17	Gray Shale and Salt	20%
	1364	1375	11	Red and Gray Shale	
	1375	1395	20	Red and Gray Shale and Salt	10%
	1395	1425	30	Gray Shale	
	1425	1518	93	Gray Shale with trace of Salt	
	1518	1612	94	Red and Gray Shale	
	1612	1622	10	Gray Shale and Salt	20%
	1622	1642	20	" " " "	50%
	1642	1652	10	" " " "	30%
	1652	1672	20	" " " "	20%
	1672	1722	50	" " " "	5%
	1722	1732	10	Red and Gray Shale	
	1732	1765	33	Gray Shale	
	1765	1773	8	Gray Shale and Salt	10%
	1773	1783	10	" " " "	70%
	1783	1793	10	" " " "	20%

No. 20 H. P. Brine Well

	1793	1798	5	Gray Shale	
	1798	1805	7	Gray Shale and Salt	30%
	1805	1815	10	" " " "	50%
	1815	1825	10	Red and Gray Shale and Salt	10%
	1825	1855	30	Red and Gray Shale with trace of Salt	
	1855	1865	10	Gray Shale and Salt	10%
	1865	1905	40	Red and Gray Shale with trace of Salt	
	1905	1945	40	Red and Gray Shale	
	1945	1955	10	Red and Gray Shale and Salt	60%
	1955	1965	10	" " " " " "	70%
	1965	2055	90	Red and Gray Shale	
13 3/8" casing	2055	2238	183	Gray Shale	
set-up 2172' 11 1/2"	2238	2240	2	Gray Shale and Salt	10%
	2240	2260	20	" " " "	50%
	2260	2269	9	" " " "	10%
	2269	2274	5	" " " "	50%
	2274	2281	7	Red Shale and Salt	80%
	2281	2310	29	Red and Gray Shale	
	2310	2349	39	Gray Shale	
	2349	2368	19	Gray Shale and Salt	50%
	2368	2376	8	" " " "	90%
	2376	2385	9	" " " "	10%
	2385	2431	46	Red and Gray Shale	
	2431	2439	8	Red and Gray Shale and Salt	10%
	2439	2446	7	Red and Gray Shale	
	2446	2466	20	Red and Gray Shale and Salt	20%
	2466	2471	5	" " " " " "	10%
	2471	2490	19	Gray Shale and Salt	20%
	2490	2497	7	" " " "	40%
	2497	2503	6	Gray Shale	
	2503	2522	19	Gray Shale and Salt	10%
	2522	2530	8	" " " "	50%
	2530	2568	38	Gray Shale	
	2568	2578	10	Gray Shale and Salt	10%
	2578	2617	39	Red and Gray Shale	
	2617	2680	63	Gray Shale	
	2680	2687	7	Gray Shale and Salt	20%
	2687	2697	10	" " " "	60%
	2697	2723	26	" " " "	40%
	2723	2817	94	Red and Gray Shale	
	2817	2825	8	Gray Shale	
	2825	2828	3	Gray Shale and Salt	20%
	2828	2841	13	" " " "	50%
	2841	2887	46	Red and Gray Shale	
	2887	2897	10	Gray Shale and Salt	50%
	2897	2912	15	" " " "	95%
	2912	2920	8	" " " "	65%
	2920	2934	14	" " " "	95%
	2934	2969	35	Red and Gray Shale	
	2969	2984	15	Gray Shale and Salt	70%
	2984	2994	10	" " " "	20%
	2994	3021	27	Red and Gray Shale	
	3021	3030	9	Gray Shale and Salt	10%
	3030	3040	10	" " " "	70%
	3040	3060	20	Red and Gray Shale	
	3060	3075	15	Gray Shale and Salt	10%

3075	3119	44	Red and Gray Shale	
3119	3130	11	Gray Shale and Salt	50%
3130	3143	13	" " " "	80%
3143	3176	33	" " " "	95%
3176	3186	10	" " " "	75%
3186	3198	12	Red and Gray Shale	
3198	3210	12	Gray Shale and Salt	50%
3210	3217	7	" " " "	80%
3217	3305	88	" " " "	98%
3305	3340	35	Gray Shale and Gypsum	
3340	3356	16	Gray Shale and Salt	90%
3356	3609	253	Gray Shale and Gypsum	
3609	3649	40	Gray Shale and Salt	30%
3649	3685	36	Gray Shale and Gypsum	
3685	3700	15	Gray Shale and Salt	50%
3700	3716	16	Gray Shale	
3716	3725	9	Gray Shale and Gypsum	
3725	3739	14	Gray Shale and Salt	25%
3739	3768	29	" " " "	65%
9 5/8" casing	3768	17	" " " "	30%
set-up 3780' 2 1/4"	3785	43	" " " "	75%
5 1/2" tubing	3828	16	Gray Shale	
set-up 3825' 9 1/4"	3844	6	Gray Shale and Salt	20%
2" tubing set-up	3850	35	Gray Shale	
3830' 8 1/4"	3885	7	Gray Shale and Salt	40%
	3892	16	Gray Shale	
	3908	4	Sandstone	
	3908			

Total Depth 3912 feet

Pipe	Set-up
20".....	49' 8"
16".....	943' 1"
13 3/8".....	2172' 11 1/2"
9 5/8".....	3780' 2 1/2"
5 1/2".....	3825' 93/4"
2".....	3830' 8 1/2"

16" - 13 3/8" 3360 bags cement

Inner connected with #16 Well 2-5-71

3912  
22  
3712

STANDARD S &amp; P "NORFOLK"

Abandonment History - Well CH-20

- 11-30-72 Rigged up cementing equipment to 13 3/8" - 9 5/8" annulus and pumped 150 bbls of fresh and salt water at 1400 - 1750 psi with fair circulation up 5 1/2" - 2 3/8" annulus. Connected to 9 5/8" - 5 1/2" annulus and pumped 175 bbls of fresh and salt water at 600 psi with good circulation up 5 1/2" - 2 3/8" annulus. Connected to 2 3/8" tubing and pumped 20 bbls of salt water at 0 psi with good circulation up 5 1/2" - 2 3/8" annulus.
- Reconnected to 13 3/8" - 9 5/8" annulus and pumped 24 bbls of chemical pre-flush, 6 bbls of gelled water, 20 bbls of 16.8-lb neat cement, 114 bbls of water, and 2 bbls of 16.8-lb neat cement at 1200 - 1500 psi. Shut down for night.
- 12-1-72 Connected to 9 5/8" - 5 1/2" annulus and pumped 5 bbls of gelled water, 6.5 bbls of 15.6-lb neat cement, 26 bbls of water, and 3 bbls of 15.6-lb neat cement at 0 psi. Could not pump programmed amount of displacement water (87.5 bbls) between cement plugs due to leak in weld at juncture of 6" line with casing head. Connected to 5 1/2" - 2 3/8" annulus and pumped 4 bbls of gelled water, 3 bbls of 15.6-lb neat cement, 14 bbls of water, and 2 bbls of 15.6-lb neat cement at 0 psi. Did not pump programmed amount of displacement water (31 bbls) between plugs because circulation up 2 3/8" tubing stopped. Connected to 2 3/8" tubing and pumped 5 bbls of 15.6-lb neat cement at 0 psi. All three strings on vacuum at completion of job.
- 12-4-72 Rigged up pumping unit to 13 3/8" - 9 5/8" annulus. Pressured to 1200 psi and held with less than 1/4 bbl of water pumped. Rigged to 9 5/8" - 5 1/2" annulus and pumped 2 bbls of water. Pressured to 1000 psi but would not hold. Rigged to 5 1/2" - 2 3/8" annulus and pumped 2 bbls of water at 0 psi. Rigged to 2 3/8" tubing and pumped 2 bbls water at 0 psi. Reconnected to 5 1/2" - 2 3/8" annulus and started pumping cement. Cement circulated to surface through 2 3/8" tubing after pumping 1 bbl of 15.6-lb neat cement, indicating hole in tubing at approximately 49'. Connected to 9 5/8" - 5 1/2" annulus and squeezed 2 bbls of 15.6-lb neat cement in stages. Squeezed to 750 psi and pressure held.
- 12-5-72 Opened all casing valves and no leakage found. Olin to remove all valves and cap with blank flanges, leaving wellhead as abandonment marker. Wellhead to be tagged with well name and number.

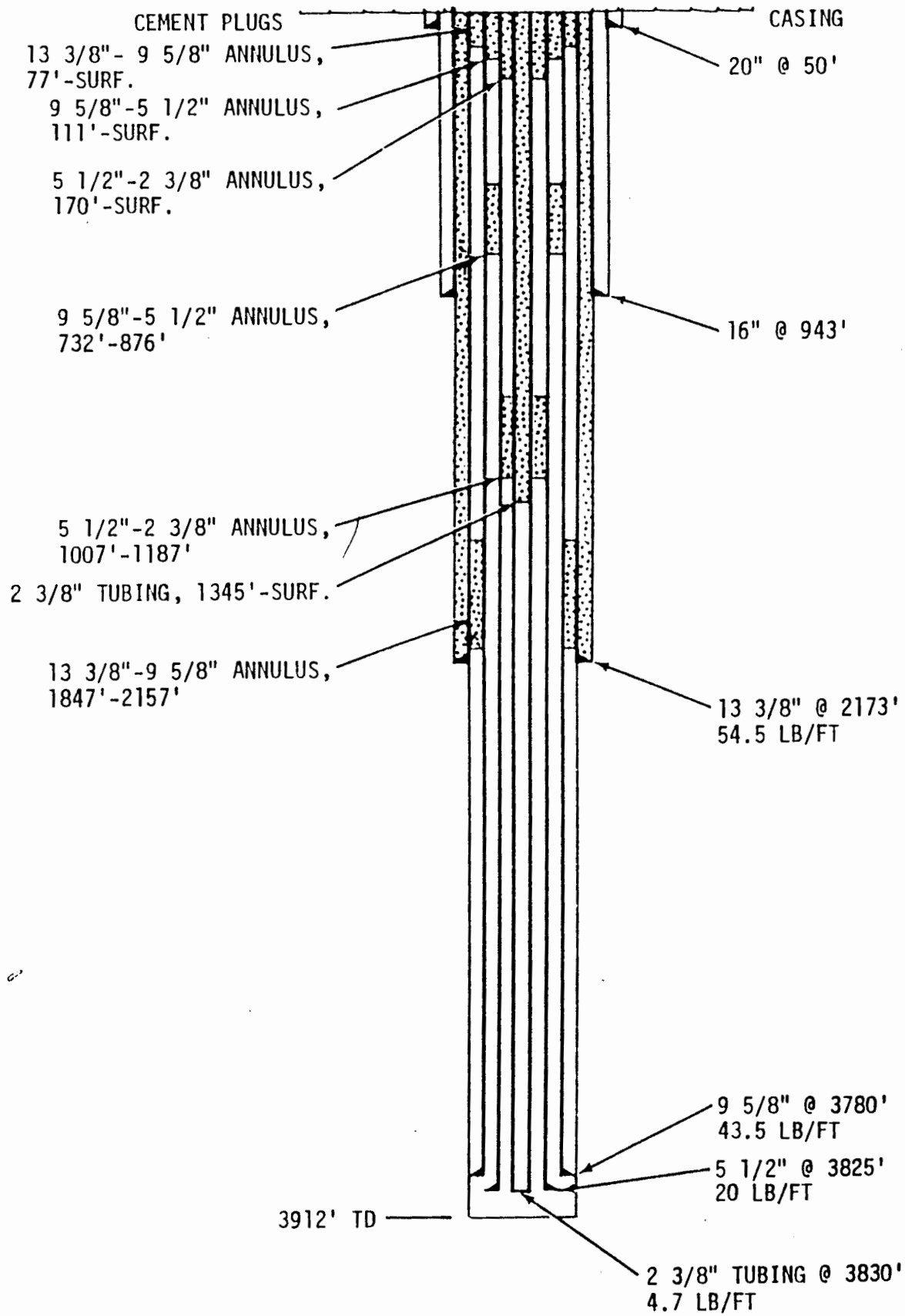


Figure 15. Existing configuration of well CH-20 (Category I).

COMMONWEALTH OF VIRGINIA  
DEPARTMENT OF LABOR AND INDUSTRY  
DIVISION OF MINES  
Big Stone Gap, Virginia

## AFFIDAVIT OF PLUGGING AND FILLING WELL

(Required by Section 45.1-128, Code of Virginia, 1966)

(Affidavit should be made in triplicate. One copy mailed to the Division of Mines, one copy retained by the well operator, and the third copy (additional copies if required) mailed to any (each) interested mine owner or operator.)

<u>Olin Corporation</u> <small>Mine Operator or Owner</small>	<u>None</u> <small>Adjoining Well Operator</small>
<u>120 Longridge Road</u> <small>Address</small>	<u></u> <small>Address</small>
<u>Stamford, Connecticut 06904</u> <small>Address</small>	<u></u> <small>Address</small>

(Submit additional names and addresses, if any, on attached sheet.)

Department of Labor and Industry  
Division of Mines  
Big Stone Gap, Virginia

<u>December 3</u> , 19 <u>72</u> <small>Date</small>	<u>Olin Corporation</u> <small>Well Operator</small>
	<u>120 Longridge Road</u> <small>Address</small>
	<u>Stamford, Connecticut 06904</u> <small>Address</small>

## Well and Location

	<u>9</u> District
Well No. <u>CH 20 - Salt Water</u>	<u>Washington</u> County
Permit No. <u></u>	<u>Saltville</u> Farm

## AFFIDAVIT

State of Virginia Smyth } ss.  
County of

E. C. Sessions, Fenix & Selasson, Inc. and F. Suhy, Dowell, Division of Dow Chemical Co

being first duly sworn according to law depose and say that they are experienced in the work of plugging and filling oil and gas wells and were employed by Olin Corporation, well operator, and participated in the work of plugging and filling the above well, that said work was commenced on the 30th day of November 1972, and that the well was plugged and filled in the following manner:

(OVER)

SAND OR ZONE	FILLING MATERIAL			PLUGS USED	CASING		
	FORMATION	CONTENT	FROM To		SIZE AND TYPE	CGS PULLED	CGS LEFT IN
		6 bbls. gel	2250	2157	None	None	13 3/8" @ 2173'
		20 bbls. neat cmt (120 sks.)	2157	1847			
		5 bbls. neat cmt (30 sks.)	77	Surface			
		5 bbls. gel	987	876	None	None	9 5/8" @ 3780'
		6.5 bbls. neat cmt (33 sks.)	876	732			
		5 bbls. neat cmt (25 sks.)	111	Surface			
		4 bbls. gel	1427	1187	None	None	5 1/2" @ 3825'
		3 bbls. neat cmt (15 sks.)	1187	1007			
		2.8 bbls. neat cmt (14 sks.)	170	Surface			
		5.2 bbls. neat cmt (26 sks.)	1345	Surface	None	None	2 3/8" @ 3830'
Note: Checked cmt. job: 13 3/8" pressured to 1200 psi. o.k.; squeezed 2 bbls. cmt down 9 5/8 to 750 psi, pumped 1 bbl. cmt. down 5 1/2" & circulated out 2 3/8" tbg.							
All protective strings of casing were left in hole.							
Coal Seams	Not Applicable			DESCRIPTION OF MONUMENT 			
(Name)							
(Name)							
(Name)							
(Name)							
(Name)							
(Name)							

(Give additional information on supplemental sheet and attach same hereto.)

that the work of plugging and filling said well was completed on the 4th day of December, 1972 that a "bleeder pipe" was (or was not) installed, and that a permanent monument of concrete (or concrete and iron) was erected over the well location in compliance with the provisions of Chapter 12, Title 45, Code of Virginia, 1966.

And further deponents saith not.

E.C. Sessions  
Frederick Salig  
 Sworn to and subscribed before me this 12th day of December, 1972  
Nila H. Webb  
 Notary Public

My commission expires Sept. 6, 1976

MID-AMERICA PIPELINE COMPANY  
(MAPCO)

CH-20  
RE-ENTRY PROGRAM  
DAILY REPORTS

166783

SALTVILLE UNDERGROUND STORAGE CO.  
WELL--CH-20

- 2-27-79 Moving rig from CH-16 to CH-20.
- 2-28-79 Moving rig from CH-16 to CH-20.
- 3-1-79 Rigging up. Set sub structure and drilling unit.
- 3-2-79 Rigging up. Raise derrick set in fuel trailer, tool and dog house trailer, set pipe tubs. Start stripping well head.
- 3-3-79 Rigging up. Move and rack 3½" drill collars and 2 7/8" drill pipe. Set water tanks and fill with water. Finish stripping well head and install 13 3/8" drilling nipple, water truck breaks down, dozer breaks down.
- 3-4-79 Going in hole with overshot this a.m. at 119'. Set pits and connect pump. Dig rat hole and install shuck with kelly. Start work over operations at 10:00 p.m. 3-3-79. Pick up 4 1/8" overshot with jars, bumper sub and go in hole with 3½" drill collars. Tag fish at 113', trip out of hole with drill collars, bumper sub, jars, and overshot. Have no recovery. Pick up 4 5/8" bladed mill and go in hole with jars, bumper sub and collars. Pick up kelly and tag fish at 113'. Rotate and circulate to 119' are on iron trip out of hole with drill collars, bumper sub, jars and mill. Start in hole with overshot.
- 3-5-79 Going in hole with 4 5/8" flat bottom mill this a.m. at 128'. Finish trip in hole with overshot, jars, bumper sub and collars. Pick up kelly and rotate over fish at 119'. Trip out of hole with drill collars, bumper sub, jars and overshot. Recover 2½" of 2 3/8" thg. Top cut with torch, bottom 2 3/8" tbg. thd. Go in hole with 4 5/8" mill with jars, bumper sub and collars. Start milling on fish to 122' are milling on iron. Trip out of hole with drill pipe, and mill. Pick up 4 1/8" overshot, dressed with 3 1/16" grapple for 2 3/8" tbg. collar, with jars, bumper sub and go in hole with drill collars. Pick up kelly and go over fish.. Trip out of hole with drill collars and overshot. No recovery. Pick up 3 13/16" kut rite shoe with 1 jt. 3 13/16" washpipe and go in hole with drill collars. Pick up kelly and start washing over 2 3/8" tbg. at 122' wash to 128', washing on iron. Trip out of hole with drill collars, washpipe and shoe. Shoe O.D. is tapered to 3" O.D. indicates 5½" csg. collapsed or parted. Pick up 8 3/8" shoe with 8 1/8" washpipe. Unable to find top bushing for 8 1/8" washpipe. Rig power swevel to wash over 5½" csg. at surface. Six hours waiting on top bushing for 8 1/8" washpipe. Start washing over 5½" csg. at surface at 11:00 p.m. 3-4-79. Wash to 140' and fall free. Run wash pipe to 182'. Trip out of hole with wash pipe and shoe.

SALTVILLE UNDERGROUND STORAGE CO.

WELL CH-20

- 3-6-79 Going in hole with 4 5/8" bit with 3 1/2" collars this a.m. at 166'. Pick up 4 5/8" flat bottom kut-rite and go in hole with collars. Pick up kelly and start milling on fish at 128'. Mill to 134' in 6 hours. Trip out of hole with collars and mill. Mill is worn on O.D., no wear on bottom. Pick up 8 1/8" X 5 1/2" outside csg. cutter and go in hole with washpipe. Cut 5 1/2" csg. at 128' trip out with washpipe and lay down. 5 1/2" csg. Go in hole with 8 1/8" cutter with washpipe and cut 5 1/2" csg. at 160'. Trip out with washpipe and lay down 1 jt. 5 1/2" csg. filled with hard cement. Rig down power swevel, lay down 3" kelly and pick up 6" kelly. Pick up 7 3/8" X 4 5/8" skirted mill with 4-5 1/2" drill collars. Pick up kelly and tag fish at 160'. Start milling on cement in 5 1/2" csg. mill to 166'. Trip out of hole with drill collars and skirted mill. Pick up 4 5/8" bit with 3 1/2" collars.
- 3-7-79 Drilling cement in 5 1/2" csg. at 291' this a.m., made 125'. Finish going in hole with 4 5/8" bit and 3 1/2" collars. Pick up kelly and work into 5 1/2" stub at 160'. Start drilling cement at 166'. Drill to 191'. Pick up and make connection work, bit into 5 1/2" stub at 160'. Start drilling at 191'. Pump pressures up. Trip out of hole with drill pipe and collars, have backed bit off bottom collar. Pick up 8 3/8" shoe, with 8 1/8" washpipe, with 5 1/2" collars and go in hole with drill pipe. Pick up kelly and clear outside 5 1/2" csg. to 220'. Trip out of hole with drill pipe and collars. Brake to bushing on washpipe, have 4 5/8" bit wedged in top of washpipe. Recover bit, finish trip out with washpipe and shoe. Pick up bit with 3 1/2" drill collars and go in hole with drill pipe. Work into 5 1/2" stub at 160'. Pick up kelly and start drilling cement at 191'. Drill cement to 291' in 16 hours.
- 3-8-79 Waiting on McCullough, this a.m. at 3718'. Drill from 291' to 547' and fall free. Run 2 7/8" drill pipe to 1322' hit bridge. Drill cement from 1322' to 1510' fall free. Run total of 119 jts. Drill pipe and collars and tag bottom at 3718'. Pick up kelly, unable to brake circulation bit plugged. Trip out of hole with drill pipe, collars and bit ground level. CH-16 2150' bottomed at 3668. Ground level CH-20 2205' bottomed at 3718. 55' GL difference and 50' bottom difference. Call McCullough to run neutron-gamma ray and collar log. Will attempt to run caliper.

LL CH-20  
Page 2

- 3-9-79 Laying down 5½" csg. from back off at 489' this a.m. Rig McCullough wire line unit and run neutron-gamma ray and collar log. Find bottom at 3719'. Are unable to log neutron and gamma ray is damped. Are picking up csg. collars. Are in csg. run caliper and capiler I.D. of csg. at 4.75 are in 5½" csg. Run free point and find 5½" csg. stuck at 485'. Attempt to release overshot have movement in 5½" csg. and are turning 5½" csg. Unable to release overshot. Rig McCullough and perforate 5½" csg. at 1208'. Run back off charge and back off 5½" csg. at 489'. Trip out of hole with drill pipe, overshot and start laying down 5½" csg.
- 3-10-79 Laying down 5½" csg. this a.m. from 3719'. Lay down 9 jts. 5½" csg. Pick up overshot with jars, bumper sub, 2 stds. 5½" drill collars, accelerator sub and go in hole with 4" drill pipe. Pick up kelly and latch onto 5½" csg. at 489'. Start working 5½" csg. Start circulating hole while working pipe have partial returns to surface. Working pipe to 160,000' and work free, start pulling csg. with 80,000'. Pull 4" drill pipe with accelerator sub, collars, bumper sub and overshot. Start laying down 5½" csg. Have pulled and racked 62 jts. 5½" csg. this a.m.
- 3-11-79 Rig up basin surveys logging unit this a.m. Finish trip out of hole with 36 jts. 5½" csg. Have pulled and layed down total of 108 jts. 5½" csg. for 3725'. Have strainer sub on bottom of 5½" csg. Pick up 8 5/8" bladed mill with 2 stds 5½" drill collars and go in hole with 2 7/8" drill pipe. Tag cement bridge at 1059'. Pick up kelly and start reaming cement from 1059' to 1320'. Falls free. Run mill to 3676' and hit obstruction. Pick up kelly and start milling at 3676' are milling on iron. Trip out of hole laying down 2 7/8" drill pipe. Stand back 2 stds 5½" collars. Rig basin surveys logging unit.
- 3-12-79 Trip out with drill pipe, collars and cutter this a.m. Make dummy run with 3½" O.D. tool to 3723'. Run neutron-gamma ray and collar log from 3722' back to 1700'. Do not have caliper on logging unit wait on caliper. Pick up 9 5/8" inside csg. cutter with 2 stds. 5½" collars and pick up and go in hole with 113 jts. 4" drill pipe. Tag bottom 9 5/8" csg. at 3679'. Lay down 1 jt. drill pipe and pick up kelly. Cut 9 5/8" csg. at 3670', csg. drops 6" but does not fall completely free. Start out of hole with drill pipe.

SALTVILLE UNDERGROUND STORAGE CO.

WELL CH-20

- 3-13-79 Rig basin surveys to run caliper this a.m. Finish trip out of hole with drill pipe, collars and cutter. Pick up 8 5/8" bladed mill with 2 stds. 5 1/2" collars and go in hole with 4" drill pipe. Tag 9 5/8" csg. at 3673'. Start milling on 9 5/8" csg. mill to 3676' are spinning on iron mill worn out. Trip out of hole with drill pipe, collars and mill. Pick up 7 7/8" bit with collars and go in hole with drill pipe. Tag 9 5/8" csg. at 3676' and work bit past csg. Run to 3696' and start drilling new hole drill from 3696' to 3841'. Trip out of hole with drill pipe, collars and bit. Rig basin surveys to run caliper.
- 3-14-79 Trip out of hole with 9 5/8" csg. cutter this a.m. Run caliper to 3713' and set down pick up and hang at 3694'. Set down are are free to 3713'. Extend arms and are in hole in excess of 30". Are unable to pull caliper are hanging at 3694'. Pull line into at and leave caliper in hole. Have 12' on odometer when line is pulled. Rig McCullough wire line unit and go in hole with caliper run to 3665' reaming in 9 5/8" csg. extend arms on-caliper. Caliper guages 9 5/8" csg. to 5 1/2" increasing to 8 3/4" at 3434'. Have indication 9 5/8" csg. in bowed. Pick up 9 5/8" inside cutter with 5 1/2" collars and go in drill pipe. Cut 9 5/8" csg. at 3553' 9 5/8" csg. fall out below cut. Pull cutter into 9 5/8" csg. Try to go down cutter sets in bottom of 9 5/8" csg. above cut. Start out of hole.
- 3-15-79 Waiting on Howco to run deviation sur. this a.m. Finish trip out of hole with drill pipe, collars and 9 5/8" cutter. Pick up 8 5/8" mill with drill collars and go in hole with drill pipe, tag cut at 3553'. Work mill thru cut and back into 9 5/8" csg. below cut. Well flowed 10 bbls. oil and 187 bbls. water to pit. From 9 5/8" csg. Trip out of hole with drill pipe, collars and mill. Pick up 7 7/8" bit with 9 5/8" inside csg. cutter with drill collars and go in hole with drill pipe. Tag cut at 3553' work 7 7/8" bit thru cut unable work 9 5/8" cutter past cut. Trip out of hole with drill pipe, collars and cutter with bit. Lay down cutter and go in hole with 7 7/8" bit with collars and drill pipe. Waiting on Howco to run deviation surveys.
- 3-16-79 Finish trip in hole with drill pipe, tag bottom at 3694'. Pick up and land bottom drill collars with bit at 3670'. Rig Howco wire line reel with 16° inclination bomb and run deviation survey at 3665' - 5°, 3570' - 4°, 3470' - 3° and 3370' - 1°. Drop 10° inclination instrument and trip out of hole with drill pipe, collars and bit. Deviation at 3670' - 5°. Run survey in 9 5/8" csg. to 3539' - 3°. Pick up 8 1/8" box tap with drill collars and go in hole with drill pipe. Run past csg. cut at 3553' and hang drill pipe at 3615'. Rig McCullough and run caliper to 3650'. Pull back into drill pipe at 3515'. Caliper range from 7 1/2" to 8 3/4" repeat run from 3670' to 3615' with caliper range 7 1/2" to 8 3/4" with csg. collar

SALTVILLE UNDERGROUND STORAGE CO.  
WELL CH-20

Page 2

at 3642' are inside 9 5/8" csg. below cut. Pick up drill pipe to 3418' above cut at 3553'. Run caliper to 3530 with 8 3/4" reading. Run caliper to 3568' and set down. Pull caliper have 15" hole to 3560' pull into 9 5/8" csg. with 8 3/4" gauge to drill pipe at 3418'. Run drill pipe past cut at 3553' and land at 3584'. Run caliper to 3670' and pull back into drill pipe at 3584' caliper ranges from 6" to 8 3/4". Trip out of hole with drill pipe, collars and box tap.

- 3-17-79 Waiting on tools this a.m. Install B.O.P. and connect flow line to pit. Go in hole with drill collars and pipe opened to displace oil in hole out with water.
- 3-18-79 Waiting on tools this a.m. Circulate hole with water. Recover 36 bbls oil have Alegehana water truck fill tanks and pits with water.
- 3-19-79 Waiting on dozer this a.m. Circulate hole to balance fluids in hole. Truck with 11 3/4" washpipe arrives in Saltville from Louisiana 1:30 p.m. 3-18-79. Truck with tools from Tri-state, Clarksburg, VA. arrives in Saltville 10:30 p.m. 3-18-79. Trucks are unable to climb hill to location. Call for dozer operator.

SALTVILLE UNDERGROUND STORAGE CO.

CH-20

- 3-20-79 Washing over 9 5/8" csg. at 13' this a.m. Move tools and washpipe from Saltville to CH-20 location. Rig up power swivel pick up 12" O.D. Kut-Rite shoe with 1 jt. 1 1/4" washpipe and start washing over 9 5/8" csg. at surface, at 7:00 p.m. 3-19-79.
- 3-21-79 Waiting on tools this a.m. at 17' made 4'. Washing over 9 5/8" csg. incounter 9 5/8" csg. collar at 17'. Pressure up with pump. Are pumping into cavern with no returns to surface. Will run 9 5/8" plug and set in 9 5/8" csg. at 2500'.
- 3-22-79 Milling over 9 5/8" csg. at 33' this a.m., made 16'. Pick 8 5/8" O.D. mill on drill collars and go in hole with drill pipe. Run to 2742' to insure full gauged hole. Trip out of hole with drill pipe, collars and mill. Rig McCollough wire line unit. Pick up Howco 9 5/8" E-Z drill plug. Go in hole and set plug at 2470'. Resume milling over 9 5/8" csg. Mill to 33'.
- 3-23-79 Milling over 9 5/8" csg. at 45' this a.m. Made 12' mill from 33' to 45' in 12 hours. Change shoe at 41' for 9 5/8" csg. collar. Are having drum clutch trouble, clutch is slow in releasing.
- 3-24-79 Milling on 9 5/8" csg. with pilot mill this a.m. at 52'. Trip out of hole with washpipe and shoe. Lay down power swivel. Pick up 9 5/8" inside cutter and cut 9 5/8" csg. at 47'. Pick up 9 5/8" center speare. Do not have X-over sub to get to drill pipe. Six hours waiting on X-over sub. Pick up 9 5/8" center spear with jars and bumper sub on kelly and jar 9 5/8" csg. Free at cut at 47'. Lay down 9 5/8" csg. Are cutting on body of 9 5/8" csg. with shoe. 9 5/8" X 13 3/8" csg. are side by side. Pick up 8 5/8" X 10 5/8" pilot mill with 1-5 1/2" drill collar on kelly and start milling on 9 5/8" csg. at 47' at 1:00 a.m. 3-24-79. Mill to 52' in 7 hours, made 5'.
- 3-25-79 Milling on 9 5/8" csg. at 67' this a.m., made 15'. 24 hours milling on 9 5/8" csg. with pilot mill made 15'.
- 3-26-79 Waiting on McCullough this a.m. Mill from 67' to 74'. Have 40 hours on mill. Change mills and mill from 74' to 87'. Start out of hole with mill and start dragging at 74' and stick mill at 47'. Pull to 150,000 unable to pull or go down. Call McCullough to back off collar.

SALTVILLE UNDERGROUND STORAGE COMPANY

CH-20

*15 report file well no?*

- 3-27-79 Installing B.O.P. this a.m. Rig McCullough wire line unit and back off 5½" collar. Pick up kelly and screw into collar left in hole. Brake circulation are unable to rotate or work pipe. Back kelly from collar. Pick up bumper sub with 1 std. collars, go in hole and screw into collar in hole. Work bumper sub with collars knocking down unable to free mill. Back bumper sub from collar waiting on driving tool. Lay down B.O.P. Rig driving tool and start driving down on drill collar and mill. Knock mill down and free. Lay down driving tool and pick up kelly. Rotate mill are free, lay down kelly and pull drill collar with mill. Have large chunks cement above mill. Reinstall B.O.P. Have window in 13 3/8" csg. from 47' to 87'.
- 3-28-79 Going in hole with inside cutter to cut 9 5/8" at 1800'. Pick up 9 5/8" inside csg. cutter with drill collars and go in hole with drill pipe, cut 9 5/8" csg. at 1700'. Trip out with drill pipe collars and cutter. Pick up 9 5/8" spear with jars, bumper sub and drill collar. Latch onto 9 5/8" csg. at 87'. Pull to 150,000# are not free. Work jars to 160,000# knock 9 5/8" csg. free. Trip out of hole laying down 50 jts. and cut off of 9 5/8" csg. Go in hole 9 5/8" spear jars, bumper sub collars, and accelerator sub on drill pipe. Latch onto 9 5/8" csg. at 1700'. Pull to 150,000# are not free. Start working jars. Work jars to 160,000#. Work jars for 2 hours. Unable to free pipe. Release spear and trip out with drill pipe, accelerator sub, collars, bumper sub, jars and spear. Pick up 9 5/8" inside cutter with collars and start in hole with drill pipe.
- 3-29-79 Preparing to mill out 9 5/8" csg. Finish trip in hole with 9 5/8" cutter, collars and drill pipe, cut 9 5/8" csg. at 1800'. Trip out with drill pipe, collars and cutter. Pick up 9 5/8" spear with jars, bumper sub, collars and accelerator sub and go in hole with drill pipe. Latch onto 9 5/8" csg. at 1700'. Pick up csg. is free. Trip out of hole with drill pipe, collars and spear. Lay down 2 jts. 9 5/8" csg. with cut off. Pick up 9 5/8" csg. cutter with collars and go in hole with drill pipe. Cut 9 5/8" csg. at 1916'. Trip out of hole with drill pipe, collars and cutter. Pick up 9 5/8" center spear with jars, bumper sub collars and accelerator sub and go in hole with drill pipe. Latch onto 9 5/8" csg. at 1800'. Pull up to 160,000# are not free. Start working jars work jars to 160,000# unable to work 9 5/8" csg. free. Release spear and trip out of hole with drill pipe, accelerator sub collars, bumper sub, jars and spear. Pump out and clean pits.

- 3-30-79 Mixing mud this a.m. prep. to milling 9 5/8" csg. Finish cleaning and fill pits, repair drum clutch on unit. Pick up collars and go in hole with drill pipe to 2400'. Build and install screen on pit. Modify pilot mill for 9 5/8" csg. ( 8 5/8" on pilot with 10 3/4" max O.D. blades.)
- 3-31-79 Going in hole with pilot mill this a.m. wt.-9# vis. 38. Rig Howco pump truck to mix mud in pits, have rig pump circulating hole. Mix 150 sks. salt gel and 10 sks. drispac. mix and circulate hole for 4 hours mud wt. 9# vis. 36 F.C. 2 2/32 cl. 50,000. Start out of hole with drill pipe. Clutch on unit will not release. Down at 2:00 p.m. 3-30-79. Pick up kelly and circulate hole while waiting on parts for clutch. Have clutch repaired at 3:00 a.m. 3-31-79. 13 hours down for cluth repair. Trip out of hole with drill pipe and collars. Pick up 8 5/8" X 10 3/4" pilot mill with 2-6" collars and start in hole with 2-stds 5 1/2" collars and drill pipe.
- 4-1-79 Changing pumps this a.m., milled to 1820' made 20'. Finish trip in hole with mill, collars and drill pipe. Tag top 9 5/8" csg. at 1800'. Pick up kelly and start milling on csg. at 1800' at 8:15 a.m. 3-31-79. Mill to 1820' make 20' in 11 hours. Wear out mill. Trip out of hole with drill pipe collars and mill. 7" X 14" pump arrives Saltville 6:00 p.m. 3-31-79. Move to location and mount engine on pump. Disconnect and move out 5" X 10" pump. Will set 7" X 14" pump in a.m. (Trucks were detained at weight station for 6 hours) Down 10 hours changing out pumps.
- 4-2-79 Circulating hole at 1856' this a.m. Made 36" 10 hours moving and setting pump. Pick up 10 3/4" X 8 5/8" pilot mill# 4 with 3 stds. collars and go in hole with drill pipe. Tag top 9 5/8" csg. at 1820'. Start milling on 9 5/8" csg. at 7:30 p.m. 4-1-79. Mill to 1838' at 12:00 midnight. 4-2-79. Make 18' in 4 1/2 hours. Trip out of hole with drill pipe, collars and mill. Pick up 10 3/4" X 8 5/8" pilot mill #5 with collars and go in hole with drill pipe. Tag top 9 5/8" csg. at 1836'. Start milling on 9 5/8" csg. at 3:30 a.m. 4-2-79 mill to 1856' at 8:00 a.m. 4-2-79. Make 18' in 4 1/2 hours. Circulate hole 1 hour.

SALTVILLE UNDERGROUND STORAGE CO.

CH-20

- 4-3-79 Waiting on mills this a.m. Milled to 1871' made 15'. Six hours waiting on mill. Pick up 8 5/8" X 10 3/4" pilot mill #6 with collars and go in hole with drill pipe. Tag 9 5/8" csg. at 1856', start milling on 9 5/8" csg. at 5:00 p.m. 4-2-79. Mill to 1871' at 7:30 p.m. make 15' mill worn out. Trip out of hole with drill pipe, collars and mill. 11 hours waiting on mill.
- 4-4-79 Waiting on fishing tools this a.m. Milled to 1890' made 19' 1 hour waiting on mills. Mills arrive in Saltville 9:00 a.m. 4-3-79. Pick up 8 5/8" X 10 3/4" pilot mill #7 with collars and go in hole with drill pipe. Tag 9 5/8" csg. at 1870'. Start milling on 9 5/8" csg. at 10:45 a.m. 4-3-79. Mill to 1882' at 1:45 p.m. 4-3-79. Make 12' mill worn out trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #8 with collars and go in hole with drill pipe. Tag 9 5/8" csg. at 1877' (total footage on mill #7-7') start milling on 9 5/8" at 4:00 p.m. 4-3-79. Mill to 1890' at 7:00 p.m. 4-3-79. Make 13' mill worn out. Trip out of hole with drill pipe and collars. Have twisted off mill, have broken pen on 4 1/2" X H box X 4 1/2" FH pen on bottom of 6" collar. 10 hours waiting on fishing tools.
- 4-5-79 Going in hole with spear this a.m. Milled to 1912' made 22' 1 hour waiting on tools. Pick up overshot with 5 3/4" grapple with jars, bumper sub, and collars and go in hole with drill pipe. Pick up kelly and tag fill at 1877'. Start circulating and circulate to 1887'. Latch onto fish. Trip out of hole with drill pipe, collars, bumper sub, jars and overshot. Recover x-oversub with pilot mill. Pick up 8 5/8" X 10 3/4" pilot mill #9 with collars and go in hole with drill pipe. Tag top 9 5/8" csg. at 1888'. Start milling on 9 5/8" csg. at 5:15 p.m. 4-4-79. Mill to 1898' at 9:15 p.m. 4-4-79. Make 10' mill worn out trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #10 with collars and go in hole with drill pipe. Tag top 9 5/8" csg. at 1897'. Start milling on 9 5/8" csg. at 12:00 midnight 4-5-79. Mill to 1912' at 3:00 a.m. 4-5-79, make 13' mill not worn out. Stop to fish 9 5/8" csg. from cut at 1916'. Circulate 1 1/2" hours, trip out of hole with drill pipe, collars and mill. Pick up 9 5/8" spear with jars, bumper sub and collars with accelerator sub and start in hole with drill pipe.
- 4-6-79 Going in hole with magnet this a.m. Finish trip in hole with drill pipe, collars, tools and 9 5/8" spear. Are unable to latch onto 9 5/8" csg. Trip out of hole with drill pipe, collars tools and spear. Rework spear. Run spear with jars, bumper sub,

collars and drill pipe. Pick up kelly and latch onto 9 5/8" csg. at 1912'. Pick up 9 5/8" csg. is not free to cut at 1916' start working jars. Work jars to 160,000# unable to knock csg. free. Attempt to release spear, unable to release spear. Return to working jars. Unable to knock, free or release from 9 5/8" csg. Continue to circulate hole call McCullough to back off collars from jars. Rig McCullough wire line unit and go in hole with string shot. Locate connection between jars and bumper sub and back off tools. Circulate hole 1 1/2 hours conditioning mud. Trip out of hole with drill pipe, collars bumper sub and jars. Have backed off at stop on spear. Pick up magnet with collars and start in hole with drill pipe.

4-7-79 Trip out with drill pipe this a.m. Finish trip in hole with drill pipe, collars and magnet. Tag bottom at 1885' are unable to circulate down. Have cement cake on wall of 13 3/8" csg. Lack 27' reaching stop on top of spear and 9 5/8" csg. Trip out of hole with drill pipe, collars and magnet. Pick up 11 3/4" shoe with top bushing and collars and go in hole with drill pipe. Tag fill at 1880'. Pick up kelly and start rotating and circulating ream cement in 13 3/8" csg. to 1912'. Start washing over 9 5/8" csg. Washover to 1916' and stub out shoe. Trip out of hole with drill pipe, collars and shoe. Have portion of 5/8" csg. collar wedged in shoe. Pick up 11 3/4" shoe with top bushing and collars and go in hole with drill pipe. Tag top 9 5/8" csg. at 1912'. Rotate and circulate on stub of 9 5/8" csg. Trip out of hole with drill pipe, collars and shoe. Do not have stop ring. Wedged in top bushing. Pick up shoe with 1 jt. 11 3/4" washpipe with collars and go in hole with drill pipe. Tag top 9 5/8" csg. at 1912'. Work over and start washing over 9 5/8" csg. at 1916' washover to 1923' are hanging washpipe at csg. collar at 1923'. Trip out of hole with drill pipe, collars, washpipe and shoe. Pick up pen end, for spear with jars, bumper sub and collars and go in hole with drill pipe, attempt to screw into spear at 1912' unable to do so. Start out of hole with drill pipe.

4-8-79 Milling on 9 5/8" csg. at 1916' this a.m. make 4'. Finish trip out of hole with drill pipe, collars, bumper sub, jars and pen end for spear. Pick up magnet, skirted with 11 3/4" shoe with collars and go in hole with drill pipe. Pick up kelly and circulate hole. Work over top of 9 5/8" csg with shoe and set down with magnet. Trip out of hole with drill pipe, collars and magnet, have stop ring for spear on magnet. Pick up pen end for spear with jars, bumper sub and collars and go in hole with drill pipe. Tag spear at 1912' screw into spear and run to 2360' Trip out of hole with drill pipe, collars, bumper sub, jars and spear. Pick up 8 5/8" X 10 3/4" pilot mill #11 with drill collars and go in hole with drill pipe. Tag top 9 5/8" csg. at 1908'. Start milling on 9 5/8" csg. at 5:00 a.m. 4-8-79.

4-9-79 Waiting for pump parts this a.m. at 1925' made 9'. Mill to 1916' mill worn out. Trip out of hole with drill pipe, collars, and mill. Pick up 8 5/8" X 10 3/4" pilot mill #12 with collars and go in hole with drill pipe. Tag top 9 5/8" csg. at 1914'. Start milling on 9 5/8" csg. 12:00 noon 4-8-79. Mill to 1917' mill falls free, at 12:15 p.m. (15 min. run on mill) Trip out of hole with drill pipe, collars and mill (mill has shuked blades) Pick up 8 5/8" X 19 3/4" pilot mill #13 with collars and go in hole with drill pipe, tag 9 5/8" csg. at 1915'. Start milling on 9 5/8" csg. at 2:45 p.m. 4-8-79. Mill to 1925' mill worn out at 7:45 p.m. 4-8-79. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #14 with collars and go in hole with drill pipe. Tag 9 5/8" csg. at 1925'. Idler brakes on pump, throttle unable to run pump down at 11:00 p.m. 4-8-79. 9 hours waiting on pump parts.

SALTVILLE UNDERGROUND STORAGE CO.

CH-20

- 4-10-79 Milling at 1936' this a.m. Made 12', 10 hours down for pump repair. Start milling with pilot mill #14 at 6:— p.m. 4-9-79 at 1924', mill to 1936' at 7:00 a.m. 4-10-79.
- 4-11-79 Milling at 1961' this a.m., made 25'. Mill to 1938' at 8:15 a.m. 4-10-79. Mill worn out. Trip out with drill pipe, collars, and mill. Pick up 8 5/8" X 10 3/4" pilot mill #15 with collars and go in hole with drill pipe. Start milling at 1938' at 12:30 p.m. 4-10-79. Mill to 1954' at 8:30 p.m. Mill worn out. Trip out with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #16 with collars and go in hole with drill pipe. Start milling at 1954' at 12:00 midnight mill to 1961' at 4:00 a.m. 4-11-79. Mill worn out. Trip out with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #17 with collars and go in hole with drill pipe. Start milling at 1961' at 7:00 a.m. 4-11-79.
- 4-11-79 Milling at 1987' this a.m. Made 26' mill to 1970' at 1:30 p.m. 4-11-79. Mill worn out. Trip out with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #18 with collars and go in hole with drill pipe. Start milling at 1970' at 5:30 p.m. 4-11-79. Mill to 1974' at 8:30 p.m. 4-11-79. Mill worn out. Trip out with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #19 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 1974' at 12:00 midnight 4-11-79. Seven hours milling, made 13'.
- 4-13-79 Milling at 2002' this a.m. Made 15'. Mill to 1989' at 9:30 a.m. 4-11-79. Mill worn out. Circulate hole two hours. Trip out of hole with drill pipe, collars and mill. Four hours waiting on mills. Pick up 8 5/8" X 10 3/4" pilot mill #20 with collars and go in hole with drill pipe. Start milling at 1989' at 5:00 p.m. 4-12-79. Mill to 1998' at 10:30 a.m. 4-13-79. Mill worn out. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #21 with collars and go in hole with drill pipe. Start milling at 1998' at 3:45 a.m. 4-13-79. Mill to 2002' this a.m.
- 4-14-79 Down for pump repair this a.m. at 2017' made 15' mill to 2010' at 11:30 a.m. 4-13-79. Mill worn out. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #22 with collars and go in hole with drill pipe. Start milling at 2010' at 2:15 p.m. 4-13-79. Mill to 2011' at 5:45 p.m. 4-13-79. Mill worn out. Trip out with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #23 with collars and go in hole with drill pipe. Start milling at 2011' at 8:00 p.m. 4-13-79. Mill to 2015' at 12:00 midnight 4-13-79 mill worn out. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #24 with collars and go in hole with drill pipe. Start milling at 2015' at 5:00 a.m. 4-14-79. Mill two hours to 2017'. Idler on pump throttle brakes down for pump repair at 7:00 a.m. 4-14-79. One hour waiting on pump.

- 4-15-79 Milling at 2025' this a.m. Made 8'. Eight hours waiting on pump repair. Have pump repaired and start milling on 9 5/8" csg. at 2017' at 4:00 p.m. 4-14-79. Mill to 2022' at 1:00 p.m. 4-15-79. Trip out of hole with drill pipe, and collars. Have twisted off X-over between 5 1/2" and 6" collars. Pick up overshot with jars, bumper sub, with collars and go in hole with drill pipe. Latch onto 6" collars at 1954'. Trip out of hole with drill pipe, collars, bumper sub, jars, and overshot. Have 6" collars with worn out mill. Pick up 8 5/8" X 10 3/4" pilot mill # 25 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2022' at 6:45 a.m. 4-15-79. Milling at 2025' this a.m.
- 4-16-79 Milling at 2051' this a.m. Made 26'. Mill to 2030' at 1:00 p.m. 4-15-79. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 1 3/4" pilot mill # 26 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2030' at 3:00 p.m. 4-15-79. \* Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill # 27 with collars and go in hole, with drill pipe. Start milling on 9 5/8" csg. at 2039' at 11:00 p.m. 4-15-79. Mill to 2049' at 4:00 a.m. 4-16-79. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill # 28 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2049' at 6:00 a.m. 4-16-79. Milling at 2051' this a.m.

\* mill to 2039' at 9:00 PM 4-15-79.

SALTVILLE UNDERGROUND STORAGE CO.

WELL-20

- 4-17-79 Trip for mill #31 at 2068' this a.m. Made 17'. Mill to 2053' at 10:15 a.m. 4-16-79. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill #29 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2053' at 12:45 p.m. 4-16-79. Mill to 2062' at 6:00 p.m. 4-16-79. Circulate hole for one hour, work B.O.P. and test to 500#. Trip out of hole with drill pipe, collars and mill. Five hours waiting on mill. Pick up 8 5/8" X 10 3/4" pilot mill #30 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2062' at 2:00 a.m. 4-17-79.\* Trip out of hole with drill pipe, collars, and mill. Pick up 8 5/8" X 10 3/4" pilot mill #31 with collars and start in hole with drill pipe.  
\* mill to 2068' at 6:15 a.m. 4-17-79
- 4-18-79 Trip out with fish this a.m. at 2084' made 16'. Finish trip in hole with drill pipe. Start milling on 9 5/8" csg. at 2068' at 8:30 a.m. 4-17-79. Mill to 2074' at 12:45 p.m. Circulate one hour. Trip out of hole with drill pipe, collars, and mill. 7 1/2 hours waiting on mill. Pick up 8 5/8" X 10 3/4" pilot mill #32 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2074' at 10:30 p.m. 4-17-79. Mill to 2084' at 4:00 a.m. 4-18-79. Trip out of hole with drill pipe, collars. Have twisted off mill. Pen broke in 4 1/2" FH box X 6 5/8" Reg. Box on top of mill. Pick up overshot with jars, bumper sub with collars and go in hole with drill pipe. Go over mill at 2084'. Start out of hole with drill pipe.
- 4-19-79 Milling at 2094' this a.m. Made 12'. Finish trip out of hole with drill pipe, collars, bumper sub, jars and overshot. Recover X-over subs, with worn out mill #32. Pick up 8 5/8" X 10 3/4" pilot mill # 33 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2082' (have 2' correction on mill #32) at 12:00 noon 4-18-79. Mill to 2086' at 4:00 p.m. 4-18-79. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill # 34 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2086' at 5:45 p.m. 4-18-79.\* Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill # 35 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2091' at 11:15 p.m. Mill to 2094' at 4:15 a.m. 4-19-79. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill # 36 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2094' at 7:15 a.m. 4-19-79.  
\* mill to 2091' at 9:00 p.m. 4-18-79
- 4-20-79 Milling at 2108' this a.m. Made 14'. Mill to 2100' at 11:15 a.m. 4-19-79. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill # 37 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2100' at 3:30 p.m. 4-19-79. Mill to 2104' at 7:15 p.m. 4-19-79. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill # 38 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2104' at 11:45 p.m. 4-19-79. Mill to 2108' at 2:30 a.m. 4-20-79. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" X 10 3/4" pilot mill # 39 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2108' at 6:30 a.m. 4-20-79.

- 4-21-79 Fishing for mill #40 at 2120' this a.m. Made 12'. Mill to 2116 at 12:45 p.m. 4-20-79. Trip out of hole with drill pipe, collars and mill. Pick up 8 5/8" x 10 3/4" pilot mill # 40 with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2116' at 2:45 p.m. 4-20-79. Mill to 2120' at 5:00 p.m. Trip out of hole with drill pipe and collars. Have twisted off X-over sub above mill. Pick up overshot, jars and bumper sub with collars and go in hole with drill pipe. Tag fish at 2120'. Trip out with drill pipe and collar, with bumper sub, jars and overshot. Do not have mill. Dress overshot with 5 1/2" grapple and start in hole with overshot, jars and bumper sub with collars and drill pipe.
- 4-22-79 Milling at 2135' this a.m. Made 18'. Finish trip in hole with overshot, jars, and bumper sub with collars and drill pipe. Tag fish at 2120'. Trip out with drill pipe, collars and tools. Do not have mill. Make total of six runs with overshot to recover mill. Have thin section of 9 5/8" csg. above mill. Pick up 9 5/8" section mill (mill #41) with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2117' at 2:30 a.m. 4-22-79. Mill to 2135' this a.m.
- 4-23-79 Trip out with spear this a.m. at 2160' made 25' circulate hole two hours and make connection. Mill to 2146' at 12:00 noon 4-23-79, made 11' (made total of 29' in six hours with section mill) Trip out of hole with drill pipe, collars and section mill. Pick up 11 3/4" shoe with collars and go in hole with drill pipe, tag fill at 2128'. Ream hole to 2152'. Circulate hole 1 1/2 hours. Circulate iron shavings and cement to pit. Trip out of hole with drill pipe, collars and shoe. Redress section mill for run # 2. Run section mill with collars and go in hole with drill pipe. Start milling on 9 5/8" csg. at 2146' at 11:30 p.m. 4-22-79. Mill to 2160' at 2:30 a.m. 4-23-79. Made 14', trip out of hole with drill pipe, collars and mill. Pick up 9 5/8" spear with jars, bumper sub, collars and accelerator sub and go in hole with drill pipe. Tag up at 2143'. Unable to latch into 9 5/8" csg. Start out of hole with drill pipe.

SALTVILLE UNDERGROUND STORAGE CO.

CH-20

- 4-24-79 Going in hole with 9 5/8" center spear this a.m. at 2160'. Finish trip in hole with spear, jars, bumper sub, collars and accelerator sub with drill pipe. Latch onto 9 5/8" csg. at 2146'. Unable to pick up on 9 5/8" csg. Trip out of hole with drill pipe, collars and tools with spear. Have 4 sections of milled out 9 5/8" csg. wrapped around spear (5' of 9 5/8" csg.). Go in hole with spear, jars, bumper sub collar, accelerator sub and drill pipe. Latch onto 9 5/8" csg. at 2151' and pick up to 100,000#. Work jars to 140,000# and knock loose from 9 5/8" csg. Trip out of hole with drill pipe, tools and spear. Have 9 5/8" csg. collar with milled out threads and 12' 9 5/8" csg. milled to 1/2 of wall gauge and broke off bottom. Pick up 8 1/8" bladed mill with collars and go in hole with drill pipe. Go into 9 5/8" csg. at 2164' and circulate down to 2180' circulate hole for three hours. Trip out of hole with drill pipe, collars and mill. Pick up 9 5/8" center spear.
- 4-25-79 Trip out with drill pipe, collars, tools and spear this a.m. Pick up spear with jars, bumper sub, collars. Accelerator sub and go in hole with drill pipe. Tag top 9 5/8" csg. at 2157'. Run spear to 2165' unable to go deeper and are unable to latch onto 9 5/8" csg. Trip out of hole with drill pipe, collars, tools and spear. Spear filled with iron cuttings. Pick up 8 5/8" bladed mill with collars and go in hole with drill pipe. Tag top 9 5/8" csg. at 2157' mill out to 2259'. Are hanging mill with iron cuttings, unable to clean hole with drilling fluid. Trip out of hole with drill pipe, collars and mill. Pick up 9 5/8" center spear with jars bumper sub, collars, accelerator sub and go in hole with drill pipe. Go in 9 5/8" csg. at 2157' and latch onto 9 5/8" csg. at 2173'. Pull to 180,000# are unable to pull 9 5/8" csg. Unable to work jars. Due to travel in spear. Release spear and start out of hole with drill pipe.
- 4-26-79 Waiting on mud this a.m. Finish trip out of hole with drill pipe, accelerator sub, collars, bumper sub, jars and 9 5/8" spear. Pick up 8 5/8" O.D. bladed mill with collars and go in hole with drill pipe. Pump out and clean out pits. Rig to mix mud.
- 4-27-79 Milling and circulating out 9 5/8" csg. at 2240'. Fill pit and tanks with water with allagheny this a.m.. ~~Waited~~ 10 hours waiting on mud. Mud arrived in Saltville 6:00 p.m. 4-26-79. Move mud to location with appalachian dozer. Unload mud, move Howco pump, truck on location and rig up. Start mixing mud at 10:00 p.m. 4-26-79. 10 hours mixing mud. Finish trip in hole with mill and tag fill at 2240' in 9 5/8" csg. Vis. 46 wt. 9.5.
- 4-28-79 Trip for redressed mill at 2462' this a.m. Mud wt. 9.5 vis. 46. Mill and circulate from 2240' to 2462'. Circulating out coarse iron cuttings. Have worn out mill. Have had periodic plugging of screen on pump suction. Trip out of hole with drill pipe, collars and mill.

**Jaltville Underground Storage .**

**Page 2**

- 4-29-79 Working on mud pump this a.m. Pick up 8 5/8" bladed mill with basket, with collars and go in hole with drill pipe. Tag fill at 2465'. Run to 2788'. Circulate hole for 2 hours. Trip out of hole with drill pipe, collars, basket and mill. Clean out and repair valves and plungers in pump, 12 hours down for repair on mud pump. (no repair parts.)
- 4-30-79 Rigging down appalachian drilling rig. Cease operations at 8:00 a.m. 4-29-79 Due to lack of interest of drilling contractor and his personnel. Move 9 5/8" csg. from CH-20 to CH-16. Lay down collars and drill pipe.

SALTVILLE UNDERGROUND STORAGE CO.

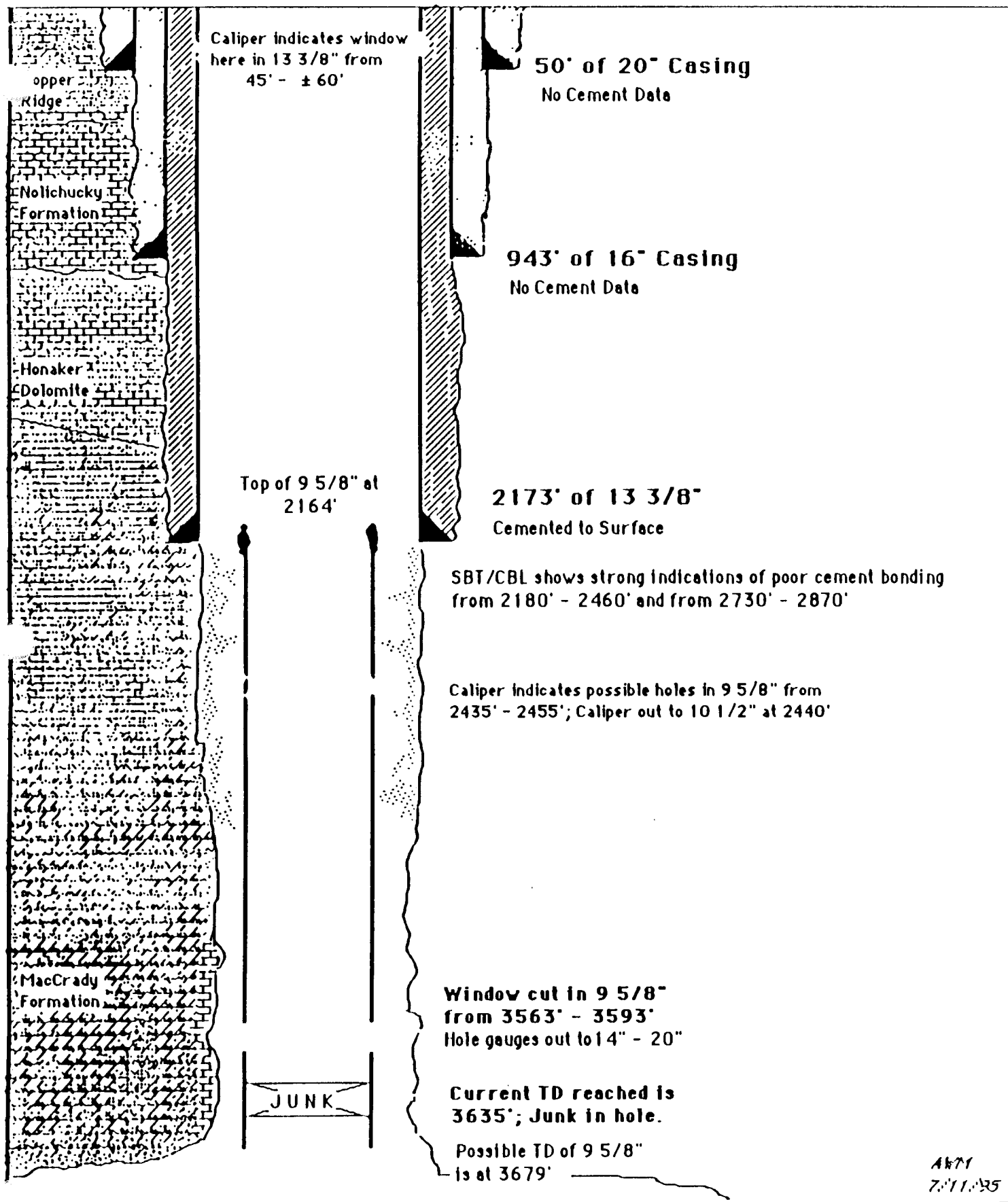
Well CH-20

- 5-1-79 Rigging down this A.M. Move Tri-State pipe and tools, from location to Clarksburg via Coats Trucking Co.
- 5-2-79 Rigging down this A.M. Clean steel pipe and rig down drilling unit.
- 5-3-79 Move drilling unit, dog house trailer, fuel trailer, and trucks to Saltville.
- 5-4-79 Move substructure and pump w/pipe.
- 5-5-79 Waiting on plug.
- 5-6-79 Waiting on plug.
- 5-7-79 Waiting on plug. Rig moved out this A.M.
- 5-8-79 CH-20  
Rig McCullough wire line unit w/service derrick and run Baker Model B 13 3/8" plug to 1500' and set. Weld 14" O.D. end cap on 13 3/8" (14 3/8" O.D.) collar w/2" ball valve w/gage T&A well.
- 5-9-79 Saltville to Jackson, Tennessee.
- 5-10-79 Jackson, Tennessee to Conroe, Texas.
- 5-11-79 Conroe, Texas to Liberty, Texas.
- 5-12-79 Liberty, Texas to Hobbs, New Mexico.

VIRGINIA GAS COMPANY

CH-20  
RE-ENTRY PROGRAM

# CII - 20 Well Schematic Prior to Plugback

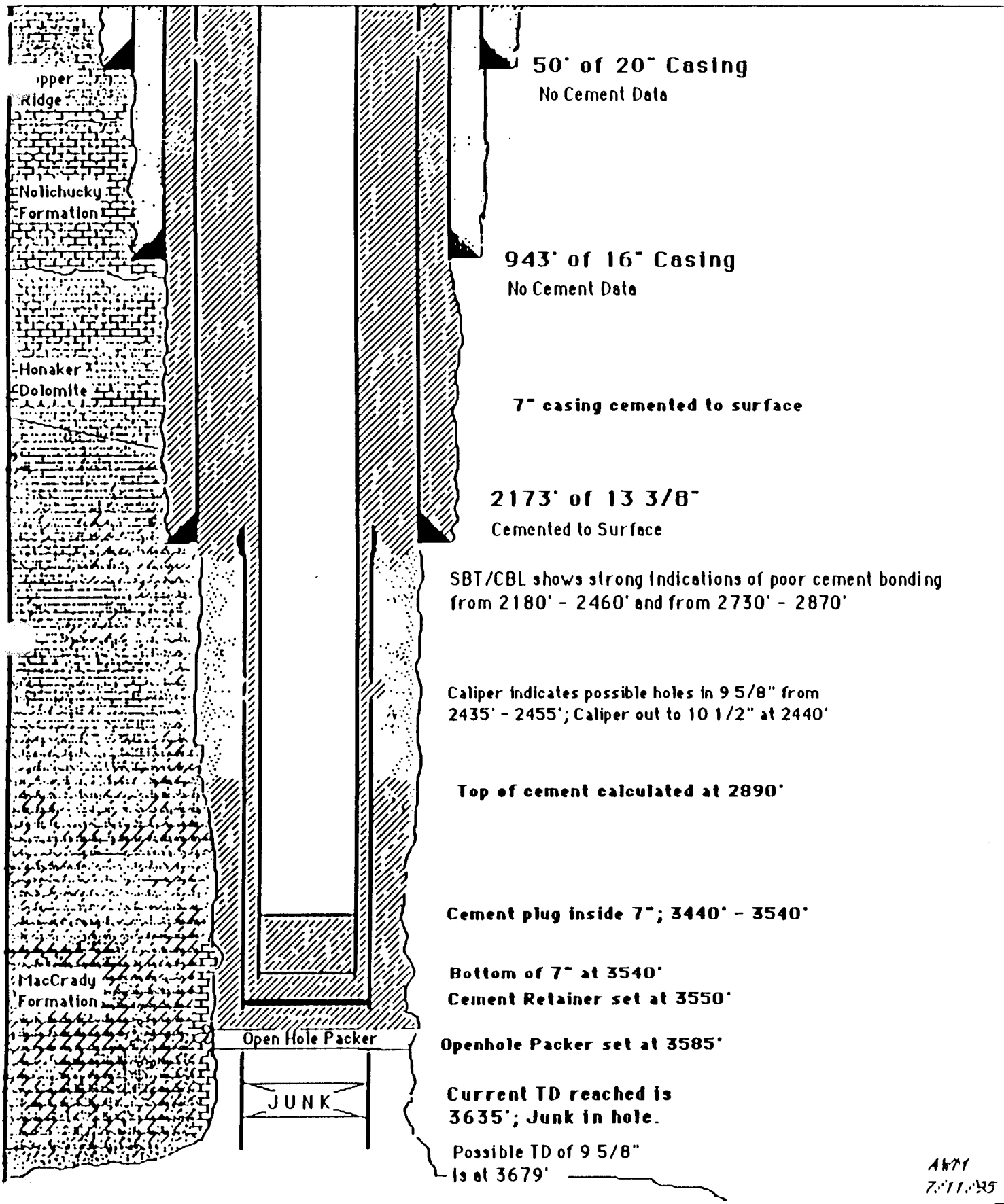


## CH - 20 Plugback Procedure

1. Move in- Rig Up Union Drilling's Rig 15 on the CH - 20 Well.
2. RIH w/ 9 5/8" tapered mill on 3 1/2" IF drill pipe and dress off top of 9 5/8" at 2164'. Bottom of 9 5/8" @ 3635' w/ open window cut at 3560' to 3590'; Run mill to bottom.
3. Run Baker Open Hole Inflatable Packer to  $\pm$  3585' and set in 15" open hole; may want to dump 20 - 30 gallon of 3" stone on top of packer for added support.
4. Squeeze 9 5/8"; RIH w/ wireline; check top of stone to make sure bottom of 9 5/8" is clear; Perforate 9 5/8" w/3 Holes at 2890'; RIH w/ drill pipe and 9 5/8" packer and set packer at 2950'; RU pump truck; do injection test to determine if hole will circulate. If hole circulates; TOOH with drill pipe and packer, and RIH w/wireline and set a cement retainer in bottom of 9 5/8" at  $\pm$  3550'; RU cement company to pump \_\_\_ sacks of a salt-based cement system and squeeze behind 9 5/8". TOOH with drill pipe, reverse circulate; WOC .
5. Wait 48 - 72 Hrs before running CBL on 9 5/8". Haul in 7" casing and float equip.
6. If cement bond good; prepare to run 7" casing; if additional cement fillup is needed for 9 5/8", re-squeeze cement at this time.
7. Run 7" casing to  $\pm$  3540'; cement back to surface; measure cement displacement with a wireline; leave 100' plug of cement in bottom of 7".
8. Install wellhead and valves with gauges; Rig down; move back to CH - 16.

AWM 7/11/95

# CII - 20 Well Schematic after Plugback



Date: 5/31/95

[illegible]

Date: 6/1/95

Cell: CH-20 Reentry

**Contractor:** WellTech, Inc.

Rig: 290

County: Washington

AFE No: 108

State: Virginia

**Activity:** Drilling Cement

Depth: 95'

24 hr. footage: \_\_\_\_\_

**CSG/TBG:**

**Deviations:**

Bit: 1 Size: 12 1/4 Type: CB-TOOTH

Cum footage: 95

Cum. Hours: \_\_\_\_\_

### Activity

**5/31/95**

0700 Rig up and set equipment.

1330 Rig up BOP and flowline to steel pit.

1430 Begin drilling cement plug, drilling 15' per hour, drilled hard cement from 0 to 40', light cement from 40 to 95'.

1830 Circulate hole clean, pull up 1 joint & SIW.

[illegible]

## Date: 6/2/95

[illegible]

Date: 6/3/95

[illegible]

Date: 6/4/95

V CH-20 Reentry Contractor: WellTech, Inc. Rig: 290

6/3/95	0700 TIH w/12" OD mill shoe (plug plucker)
	0800 Nipple up power swivel, circulate hole, pump 50 bbl drilling water to holding tank
	0835 Start milling on plug milled 1' to 1496' in 10 minutes
	0845 SD, blew oil line on power swivel truck engine and repair
	0855 Milling on plug
	0920 Milled a total of 4' to 1499'
	0945 25 minutes to mill 1", must be on upper set of slips
	1000 Milled another 1", pick up wt, set back down, milling w/5000# weight on mill
	1030 Milled another 1", pick up wt, set down w/5000# on mill
	1145 Milled through slips, start chasing junk and plug down hole to 1513'
	1210 Circulate hole @ 1513'
	1235 Trip in hole to 1863', sat down all weight, did not try to go deeper, thin drilling mud to 9ppg, circulate hole, clean @ 1863'
	1505 Start tripping out of hole w/shoe, recovered 12" cement and piece of rubber plug
	1730 S.I.W.

**VIRGINIA GAS COMPANY**  
**Daily Drilling and Completion Report**

Date: 6/6/95

Rig Day: 5

N	<u>CH-20 Reentry</u>	Contractor: <u>WellTech, Inc.</u>	Rig: <u>290</u>
County:	<u>Washington</u>	AFE No: <u>108</u>	State: <u>Virginia</u>
Activity:	<u>Rig up to run Impression block</u>	Depth: <u>2155</u>	24 hr. footage: _____
CSG/TBG:	_____		
Deviations:	_____		
Bit:	Size: _____ Type: _____	Cum footage: _____	Cum. Hours: _____
Break Down (Hours)	Activity		
<u>6/4/95</u>	<u>Rig idle on Sunday, ordered another identical mill.</u>		
<u>6/5/95</u>	<u>0700 WHP=120 psig, pressure increase from lowering the weight of drilling mud from</u>		
	<u>10.2 ppg to 9 ppg. Start cleaning out drilling pit, put in new drilling mud, weight to 10 ppg.</u>		
	<u>1100 Rig up BOP &amp; power swivel &amp; mill.</u>		
	<u>1300 Start tripping 12" OD mill back in hole, tagged something @ 1100', stopped @ 1100',</u>		
	<u>circulate hole, well on vacuum for a couple minutes. Continue to pump &amp; circulate.</u>		
	<u>1530 Continue in hole, no plug @ 1863' continue to 1953' &amp; circulate hole.</u>		
	<u>1545 Tag bottom w/ mill @ 2155', circulate hole.</u>		
	<u>1630 Start milling on plug, milled 6", starting to torque up w/ weight on mill, circulate hole,</u>		
	<u>cut off pump, set down on fish.</u>		
	<u>1800 Start TOH w/ mill. (Approx. 2 gallon of diesel in mud pit.)</u>		
	<u>1915 Recovered 2 strips of steel 3/8" x 26" &amp; 3/8" x 30", looks like cut pieces of</u>		
	<u>9 5/8' csg.</u>		
	<u>1930 SIW</u>		

Date: 6/7/95

Cell: CH-20 Reentry

Contractor: WellTech, Inc.

Rig: 290

**County:** Washington

AFE No: 108

State: Virginia

**Activity:** Run Magnet and flat bottom mill

Depth: 2155

24 hr. footage: \_\_\_\_\_

**CSG/TBG:**

**Deviations:**

Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

### Break Down (Hours)

### Activity

**6/6/95**

0700 Rig up sand line tools and impression block (12" OD)

0900 Run in hole, tag fish, trip out, no impression, not enough weight on block w/tools

1100 Take nipple to get welded at local shop

1200 Nipple up 12" OD impression block and BOP

1235 Start tripping in hole w/ 2 7/8" tubing and block. Tag fish @ 2155'

1330 Trip out of hole w/ block

1500 3 small impressions left on block, looks like small pieces of junk steel in hole

1600 S.I.W., plan to switch out B.O.P. in morning along w/ running a magnet,

a 12" OD flat bottom junk mill, and a over shot mill shoe

Date: 6/8/95

Rig Day: 7

1: CH-20 Reentry

**Contractor:** WellTech, Inc.

Rig: 290

County: Washington

AFE No: 108

State: Virginia

**Activity:** Drilling w/ flat bottom junk mill

Depth: 2156'

24 hr. footage: \_\_\_\_\_

**CSG/TBG:**

**Deviations:**

Bit: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

### Break Down (Hours)

### Activity

**6/7/95**

0700 WHP= 0 psig, unload B.O.P. and install on 13 3/8" csg, test blind rams & pipe rams.  
Fluid level @ 38'.

0900 Rig up 10" magnet on sandline, made 11 runs, recovered 6 gallons of metal shavings, check TD of fish @ 2156'.

1330 Lay down magnet, well flowing 1/4" stream, rig up 12 1/4" OD flat bottom junk mill, rig up mud pump.

1500 Trip in hole to 2104' & circulate drilling fluid.

1800 Make connection to start milling, shut down to repair/replace stripping head & rubber. SIW.

Date: 6/9/95

Well: CH-20 Reentry Contractor: WellTech, Inc. Rig: 290

County: Washington AFE No: 108 State: Virginia

Activity: Run magnet; Drill w/ 12 1/4" bit Depth: 2157' 24 hr. footage: \_\_\_\_\_

CSG/TBG: \_\_\_\_\_

Deviations: \_\_\_\_\_

Blt: \_\_\_\_\_ Size: \_\_\_\_\_ Type: \_\_\_\_\_ Cum footage: \_\_\_\_\_ Cum. Hours: \_\_\_\_\_

Break Down (Hours)	Activity
6/8/95	0700 Replace stripping head, rig up pump and power swivel, T.I.H to 2156' w/ flat bottom junk mill (12 1/4" OD)
	0800 Start milling w/4000# W.O.B. and 100 psi pump pressure. Mill 6" of fish, starting to torque up w/weight.
	1030 Trip mill out, recovered small pieces of flat metal.
	1200 Rig up and run 10" magnet on sandline, made 5 runs, recovered 1 gallon of metal shavings and small pieces of rubber bridge plug.
	1330 T.I.H w/ 12 1/4" OD tricone tooth bit.
	1500 Drill w/ 4000# W.O.B. and 200 psig pump pressure, drilled 6" of fish, to 2157', starting to torque up.
	1700 Circulate hole, shut down pump, well flowing 2" stream on its own, pump pit down to tank #4.
	1745 T.O.H., well flowing 1/2" stream for 15 minutes, bit ok, make 2 magnet runs on sandline, recovered 1 quart metal shavings.
	2000 Shut in Well

## Date: 6/10/95

Rig Day: 9

Well: CH-20 Reentry

**Contractor:** WellTech, Inc.

Rig: 290

**County:** Washington

AFE No: 108

**State:** Virginia

**Activity:** Drilling w/8 1/2" tooth bit

**Depth: 2158'**

24 hr. footage: \_\_\_\_\_

**CSG/TBG:**

**Deviations:**

Blt:                      Size:                      Type:

Cum footage: \_\_\_\_\_

Cum. Hours: \_\_\_\_\_

### Break Down (Hours)

## Activity

6/9/95	
700	WHP-O psi Run 10" magnet to 2156', recovered 1 gallon of metal shavings and small pieces of rubber, made 5 runs.
900	T.I.H. w/12 1/4 OD tri cone tooth bit, reverse circulated hole while drilling, W-L Construction cut jets and center out of bit.
1030	Started drilling w/6000# W.O.B.-100 psi pump pressure.
1330	Hole started taking fluid and stopped drilling , made 1'.
1400	T.O.O.H. w/tri cone tooth bit (12 1/4 OD).
1500	Pulled 14 stands and well started to flow out tubing, hooked up mud pump and circulated hole.
1530	Stopped pump and continued to trip out of hole.
1600	Brake out 12 1/4 OD bit and T.I.H. w/8 1/2 OD tri cone tooth bit.
1730	Drilling w/8 1/2" bit @ 2158' w/6000# W.O.B. 100 psi pump pressure, drilled 9" w/ reverse circulation.
1930	Stopped drilling, well flowing 2" stream for 20 minutes
2000	Pull up 1 joint, S.I.W. for evening.

VIRGINIA GAS COMPANY  
Daily Drilling and Completion Report

Date: 6/11/95

Rig Day: 10

Well: <u>CH-20 Reentry</u>	Contractor: <u>WellTech, Inc.</u>	Rig: <u>290</u>																										
County: <u>Washington</u>	AFE No: <u>108</u>	State: <u>Virginia</u>																										
Activity: <u>Chase BP to 3635'</u>	Depth: <u>3635'</u>	24 hr. footage: _____																										
CSG/TBG: _____																												
Deviations: _____																												
Bit: _____	Size: _____	Type: _____																										
Cum footage: _____		Cum. Hours: _____																										
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Break Down (Hours)</th> <th style="width: 85%;">Activity</th> </tr> </thead> <tbody> <tr> <td>6/10/95</td> <td></td> </tr> <tr> <td>700</td> <td>WHP-O psig, start drilling @ 2158' w/8 1/2" OD tri cone bit w/4000# W.O.B and 100 psig pump pressure.</td> </tr> <tr> <td>830</td> <td>Drilled through bridge plug @ 2160', work bit through BP and top of 9 5/8" CSG. (Top of 9 5/8" CSG @ 2164'.</td> </tr> <tr> <td>1030</td> <td>Circulate hole clean, chase parts of BP to 2186', circulate hole.</td> </tr> <tr> <td>1045</td> <td>SD pump, well flowing 2" stream to pit through drill string for 30 minutes.</td> </tr> <tr> <td>1115</td> <td>Run 20 joints to 2765' and sit down.</td> </tr> <tr> <td>1320</td> <td>Hook up power swivel and pump and circulate to 2768'</td> </tr> <tr> <td>1350</td> <td>Run 27 joint to 3584' and set down, hook up power swivel and pump and circulate down to 3592'.</td> </tr> <tr> <td>1430</td> <td>Ran 2 joints and set down @ 3635', try to circulate dull string. (No circulation)</td> </tr> <tr> <td>1500</td> <td>Shut down pump and pull 5 joints off bottom to 3504' and well flowing to pit.</td> </tr> <tr> <td>1530</td> <td>S.I.W.</td> </tr> <tr> <td colspan="2">6/11/95 &amp; 6/12/95 Rig Idle</td> </tr> </tbody> </table>			Break Down (Hours)	Activity	6/10/95		700	WHP-O psig, start drilling @ 2158' w/8 1/2" OD tri cone bit w/4000# W.O.B and 100 psig pump pressure.	830	Drilled through bridge plug @ 2160', work bit through BP and top of 9 5/8" CSG. (Top of 9 5/8" CSG @ 2164'.	1030	Circulate hole clean, chase parts of BP to 2186', circulate hole.	1045	SD pump, well flowing 2" stream to pit through drill string for 30 minutes.	1115	Run 20 joints to 2765' and sit down.	1320	Hook up power swivel and pump and circulate to 2768'	1350	Run 27 joint to 3584' and set down, hook up power swivel and pump and circulate down to 3592'.	1430	Ran 2 joints and set down @ 3635', try to circulate dull string. (No circulation)	1500	Shut down pump and pull 5 joints off bottom to 3504' and well flowing to pit.	1530	S.I.W.	6/11/95 & 6/12/95 Rig Idle	
Break Down (Hours)	Activity																											
6/10/95																												
700	WHP-O psig, start drilling @ 2158' w/8 1/2" OD tri cone bit w/4000# W.O.B and 100 psig pump pressure.																											
830	Drilled through bridge plug @ 2160', work bit through BP and top of 9 5/8" CSG. (Top of 9 5/8" CSG @ 2164'.																											
1030	Circulate hole clean, chase parts of BP to 2186', circulate hole.																											
1045	SD pump, well flowing 2" stream to pit through drill string for 30 minutes.																											
1115	Run 20 joints to 2765' and sit down.																											
1320	Hook up power swivel and pump and circulate to 2768'																											
1350	Run 27 joint to 3584' and set down, hook up power swivel and pump and circulate down to 3592'.																											
1430	Ran 2 joints and set down @ 3635', try to circulate dull string. (No circulation)																											
1500	Shut down pump and pull 5 joints off bottom to 3504' and well flowing to pit.																											
1530	S.I.W.																											
6/11/95 & 6/12/95 Rig Idle																												

VIRGINIA GAS COMPANY  
Daily Drilling and Completion Report  
Date: 6/27/95

Rig Day: 11

Jll:	CH-20 Reentry		Contractor: <u>WellTech, Inc.</u>		Rig: <u>290</u>																																																																								
County:	Washington	AFE No:	108	State:	Virginia																																																																								
Activity:	Run 4-arm caliper, GR CBL logs .	Depth:	3635'	24 hr. footage:																																																																									
CSG/TBG:																																																																													
Deviations:																																																																													
Blt:		Size:		Type:																																																																									
		Cum footage:		Cum. Hours:																																																																									
<table border="0" style="width: 100%;"> <tr> <td style="width: 15%; vertical-align: top;"> <b>Break Down (Hours)</b> </td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 45%; text-align: center; vertical-align: top;"> <b>Activity</b> </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">6/26/95</td> <td colspan="5"></td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">0700</td> <td colspan="5" style="border-bottom: 1px solid black; padding: 5px;">CH-16, WHP = 35#; CH-20; TP = 10#, Ann. Press. = 50# Flowback CH-16; recover 30 bbls; Open up CH-20 well to flowback, flow from CH-16 ceases.</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;"></td> <td colspan="5" style="border-bottom: 1px solid black; padding: 5px;">Recover 30 bbls from CH-20.</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">0830</td> <td colspan="5" style="border-bottom: 1px solid black; padding: 5px;">Tag bottom at 3635' w/ drill pipe. TOOH w/drill pipe/ bit.</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">1215</td> <td colspan="5" style="border-bottom: 1px solid black; padding: 5px;">RU Atlas Wireline to run 4-arm caliper /GR.</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">1245</td> <td colspan="5" style="border-bottom: 1px solid black; padding: 5px;">RIH w/ 55" reach caliper tool; tag top of 9 5/8" casing at 2163.5'; cannot work through 9 5/8".</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">1600</td> <td colspan="5" style="border-bottom: 1px solid black; padding: 5px;">Change out caliper tool to smaller O.D. tool w/20" reach.</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">1700</td> <td colspan="5" style="border-bottom: 1px solid black; padding: 5px;">Work through top of 9 5/8" RIH to 3593', work through window in 9 5/8"; tag T.D. @ 3635'.</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">1715</td> <td colspan="5" style="border-bottom: 1px solid black; padding: 5px;">Start logging up w/Caliper/GR; 9 5/8" casing cut at 3563' - 3593'; hole calipers out to 14" to 20"; log up to 2000', 9 5/8" casing top at 2164;</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;"></td> <td colspan="5" style="border-bottom: 1px solid black; padding: 5px;">top is inside 13 3/8" csg.</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">1730</td> <td colspan="5" style="border-bottom: 1px solid black; padding: 5px;">POOH; Caliper log completed; SIW.</td> </tr> </table>						<b>Break Down (Hours)</b>					<b>Activity</b>	6/26/95						0700	CH-16, WHP = 35#; CH-20; TP = 10#, Ann. Press. = 50# Flowback CH-16; recover 30 bbls; Open up CH-20 well to flowback, flow from CH-16 ceases.						Recover 30 bbls from CH-20.					0830	Tag bottom at 3635' w/ drill pipe. TOOH w/drill pipe/ bit.					1215	RU Atlas Wireline to run 4-arm caliper /GR.					1245	RIH w/ 55" reach caliper tool; tag top of 9 5/8" casing at 2163.5'; cannot work through 9 5/8".					1600	Change out caliper tool to smaller O.D. tool w/20" reach.					1700	Work through top of 9 5/8" RIH to 3593', work through window in 9 5/8"; tag T.D. @ 3635'.					1715	Start logging up w/Caliper/GR; 9 5/8" casing cut at 3563' - 3593'; hole calipers out to 14" to 20"; log up to 2000', 9 5/8" casing top at 2164;						top is inside 13 3/8" csg.					1730	POOH; Caliper log completed; SIW.				
<b>Break Down (Hours)</b>					<b>Activity</b>																																																																								
6/26/95																																																																													
0700	CH-16, WHP = 35#; CH-20; TP = 10#, Ann. Press. = 50# Flowback CH-16; recover 30 bbls; Open up CH-20 well to flowback, flow from CH-16 ceases.																																																																												
	Recover 30 bbls from CH-20.																																																																												
0830	Tag bottom at 3635' w/ drill pipe. TOOH w/drill pipe/ bit.																																																																												
1215	RU Atlas Wireline to run 4-arm caliper /GR.																																																																												
1245	RIH w/ 55" reach caliper tool; tag top of 9 5/8" casing at 2163.5'; cannot work through 9 5/8".																																																																												
1600	Change out caliper tool to smaller O.D. tool w/20" reach.																																																																												
1700	Work through top of 9 5/8" RIH to 3593', work through window in 9 5/8"; tag T.D. @ 3635'.																																																																												
1715	Start logging up w/Caliper/GR; 9 5/8" casing cut at 3563' - 3593'; hole calipers out to 14" to 20"; log up to 2000', 9 5/8" casing top at 2164;																																																																												
	top is inside 13 3/8" csg.																																																																												
1730	POOH; Caliper log completed; SIW.																																																																												

VIRGINIA GAS COMPANY  
Daily Drilling and Completion Report  
Date: 6/28/95

Rig Day: 12

Well: <u>CH-20 Reentry</u>		Contractor: <u>WellTech, Inc.</u>		Rig: <u>290</u>	
County: <u>Washington</u>		AFE No: <u>108</u>		State: <u>Virginia</u>	
Activity: <u>Run cased hole logs</u>		Depth: <u>3635'</u>		24 hr. footage: _____	
CSG/TBG: _____					
Deviations: _____					
Bit: _____		Size: _____		Type: _____	
		Cum footage: _____		Cum. Hours: _____	
<b>Break Down</b>					
<b>(Hours)</b>					
<b>Activity</b>					
<u>6/27/95</u>					
<u>0700</u>					
RIH w/ NEU/GR tools, cannot work past 9 5/8" top; TOOH.					
<u>0800</u>					
RIH w/Caliper/GR; Run 4-arm caliper from top of 9 5/8" to surface;					
possible window in 13 3/8" from 40' - 80'.					
<u>1000</u>					
Rerun NEU/GR tools w/centralizer; TIH to 3550' and log to surface. Did not log below 3550' because of window in 9 5/8" casing.					
<u>1330</u>					
RIH w/SBT/CBL; work through 9 5/8" and go to bottom at 3635'; log up through bottom joint to 3593' and up through open hole. No cement behind joint from 3593' - 3635';					
Continue logging up to top of 9 5/8" at 2164'; No cement behind 9 5/8" from 3593' - 2800'.					
some cement from 2800' to 2170' ; get hung at top of 9 5/8", work loose;					
continue logging to surface. Excellent cement bond from 2160' - 1260' and 975' - surface.					
Good cement bond (80% average) from 975' - 1260'; RD Atlas.					
<u>1900</u>					
Logging completed; SIW.					

VIRGINIA GAS COMPANY  
Daily Drilling and Completion Report  
Date: 6/30/95

Rig Day: 13

Well: <u>CH-20 Reentry</u>	Contractor: <u>WellTech, Inc.</u>	Rig: <u>290</u>
County: <u>Washington</u>	AFE No: <u>108</u>	State: <u>Virginia</u>
Activity: <u>Pump fluid to establish communication between caverns</u>	Depth: <u>3635'</u>	24 hr. footage: _____
CSG/TBG: _____		
Deviations: _____		
Bit: _____	Size: _____	Type: _____
Cum footage: _____		Cum. Hours: _____
<b>Break Down (Hours)</b>		
<b>Activity</b>		
<u>6/28/95</u>		
<u>0900</u>	RU pump truck to CH-16 and pump brine water at 5 BPM;	
	pumped 3 minutes and CH-20 well began to flow; pumped total of 16 bbls @	
	0 psig and shut down. Flow at CH-20 stopped when pump was shut down.	
	CH-16 backflowed 5 bbls into tank after shutting down pump.	
<u>1030</u>	RU pump truck and pump brine water at 4 - 5 BPM; pumped 8 minutes before	
	CH-16 began to flow. When pump on CH-20 was shut down, flow at CH-16 stopped.	
	The majority of the fluid (36 out of 38 bbls) backflowed out of the CH-20 when	
	pump was shut down and the bleedoff line was opened back up into the tanks.	
<u>1100</u>	Lay down drill collar; SIW; Evaluate logs	

FROM:  
PROGRAMS FOR ABANDONMENT  
of  
THE HIGH PRESSURE BRINE FIELD  
SALTVILLE, VIRGINIA

by  
FENIX & SCISSON, INC.  
Tulsa, Oklahoma  
September 15, 1972

#### 4.7 Discussion of Well No. CH 29

This well was never completed because of drilling problems. Apparently, an accumulation of downhole junk forced abandonment at about 3000'. There is no record of what was left in the hole, but surface inspection indicates that all casing smaller than 24" diameter was removed. A steel plate was welded across the 24" casing at ground level. A buried surface plug is programmed for this well to prevent accidental entry by man or beast.

Abandonment History - Well CH-29

- 12-8-72 Built 4' x 4' x 1' deep form around 24" capped casing. Welded 4 1/2" OD x 6' long pipe to cap as marker.
- 12-9-72 Filled form with concrete, making 1' thick cover over top of 24" pipe.





**FORM 4  
ATTACHMENT D**

**UNDERGROUND SOURCES OF DRINKING WATER**

**FORM 4**  
**ATTACHMENT D**

**UNDERGROUND SOURCES OF DRINKING WATER**

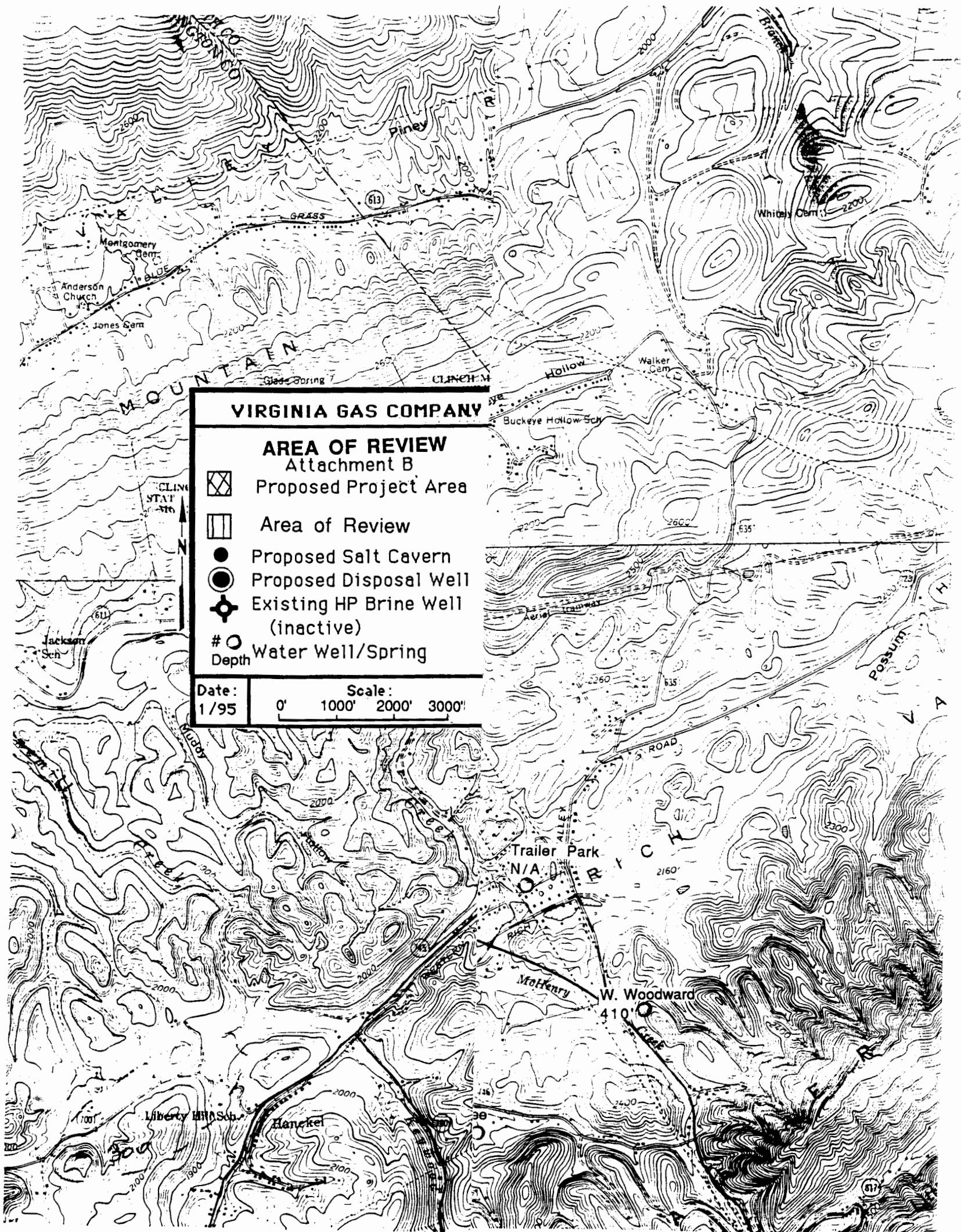
The project area falls within the Valley and Ridge Regional Aquifer as defined by the Tennessee Valley Authority in their 1981 report "Ground Water Quality Monitoring in the Tennessee Valley Region" by Wily Harris. The hydrogeology of the area indicates that ground water occurs in solution openings, bedding planes, and joints in carbonates and sandstones. The Cambrian-Ordovician carbonates are considered to be high yielding and to have a good water quality. Recharge generally occurs along outcrop areas of the aquifer.

Wells located near the town of Saltville consist mainly of drilled wells into the Honaker, Nolichucky, and Copper Ridge dolomites, and also into the Price sandstone with depths ranging from 70' to 1050'. Within the project area and area of review, only one shallow hand-dug well was located and no records are known to exist. Within one mile of the project area, one spring, locally known as the Smokey Row or Witt Spring, was identified near Plasterco. It has a permitted flow rate of 125 gpm which is the lowest recorded flow occurring during the drought of 1988. This spring is used by the Town of Saltville as a water supply. No other springs or water wells have been located within one mile.

The town's water wells, as seen on the attached map and as listed in the

attached table, "Local Fresh Water Well Data", are located in the Allison Gap and Broady Bottom areas north and northeast of Saltville and are over 2 miles away from any proposed new water wells drilled for leaching caverns. The town's average water consumption is 14,286 barrels per day (600,000 gallons per day; 417 gpm). Approximately 58% of the town's water comes from the Cardwell Town well (permitted rate of 500 gpm), approximately 21% from well #10 (permitted rate of 220 gpm), and 21% from the Smokey Row Spring. These percentages were calculated using actual 1995 numbers available from the Town. The permitted flow rates are based on 48 hour maximum draw down rates and are less than the actual flow capacities. The Cardwell Town well, the town's main source of fresh water, is located on the opposite side of the River of the project area and is recharged by Clinch Mountain. Three water wells owned by the town (the #5, #11, and #12 wells) have high bacteria counts and are therefore not used as drinking water sources. The #5 and #8 wells are currently being used by Texas Gulf Corporation as cooling water in their operations.

The area has an annual precipitation of 36 inches. According to the Southwest Virginia Water Control Board, Washington County has a Net Evaporation Number of -10.2 inches/year. Because of this, southwest Virginia's groundwater has plentiful recharge capacity.



## Saltville Storage Project

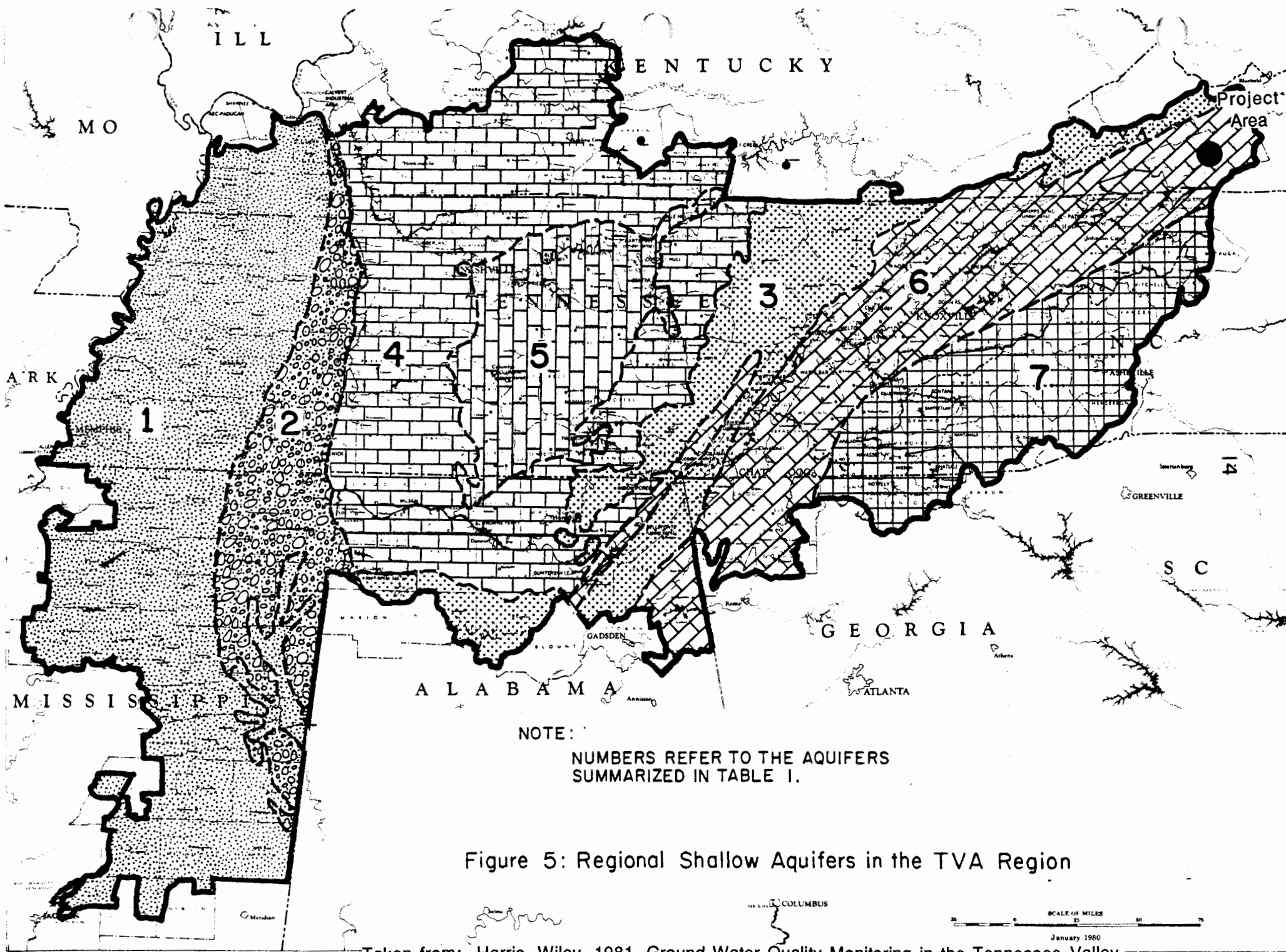
### Local Fresh Water Well Data

Water wells given to the Town of Saltville from Olin Corporation

Well No.	Total Depth (ft)	Depth Cased (ft)	Casing Size (in)	Static Water Level (ft)	Capacity (gpm)	Type Pump	Comments
- 1	816	200	13 3/8	NA	450	DW Turbine	
5	928	93	16	11	400	DW Turbine	Texas Gulf Corp uses for cooling water
6	678	147	16	60	100	DW Turbine	
7	450	200	13 3/8	17	300	DW Turbine	
8	NA	NA	NA	NA	NA	NA	Texas Gulf Corp uses for cooling water
+ 10	1050	33	20	100	240	DW Turbine	Town of Saltville uses for drinking
11	582	258	16	96	700	Submersible	
14	500	66	20	NA	750	Submersible	
15	866	65	20	8	275	DW Turbine	
+ CT	419	NA	12	Overflows	750	DW Turbine	Town of Saltville uses for drinking
+ W	Surface Spring	NA	NA	NA	190	NA	Wilt Spring is used as a back-up supply for Town of Saltville

Source: Olin Corporation records

FAM 3/2/94



NOTE:  
 NUMBERS REFER TO THE AQUIFERS  
 SUMMARIZED IN TABLE I.

Figure 5: Regional Shallow Aquifers in the TVA Region

Taken from: Harris, Wiley, 1981, Ground Water Quality Monitoring in the Tennessee Valley.

Table 2. Summary of Regional Shallow Aquifers

<u>Regional Aquifer</u>	<u>Area of Occurrence</u>	<u>Hydro-geology</u>	<u>Water Quality</u>
1. Quaternary-Tertiary	Coastal Plain	Highly permeable unconsolidated sands. Most productive aquifer in the TVA region.	Excellent quality.
2. Cretaceous	Coastal Plain	Highly permeable unconsolidated sands and gravel.	Good in outcrop area. Mineralization increases downdip.
3. Pennsylvanian	Cumberland Plateau	Secondary porosity from fractures in sandstones and conglomerates.	Excellent quality. Local problems with pH, iron and hardness.
4. Mississippian	Highland Rim	Consolidated siliceous limestones. Lower units are high yielding.	Commonly good, but locally high in dissolved solids.
5. Devonian-Ordovician	Central Basin and Sequatchie Valley	Limestones and carbonates. Secondary porosity along joints and bedding planes. Low-yielding aquifer.	Good to poor quality.
6. Valley and Ridge	Valley and Ridge	Water occurs in solution openings, bedding planes and joints in carbonates and sandstones. Cambrian-Ordovician carbonates are high yielding.	Good quality.
7. Blue Ridge	Blue Ridge	Water occurs in fractures and joints in metamorphic rock. Generally low yielding.	Good quality.

Taken from: Harris, Wiley, 1981, Ground Water Quality Monitoring in the Tennessee Valley Region: Tennessee Valley Authority.

**FORM 4**  
**ATTACHMENT F**  
**GEOLOGIC SETTING**

## **FORM 4**

### **ATTACHMENT F**

#### **GEOLOGIC SETTING**

Virginia Gas Company proposes to construct an underground natural gas storage facility in the salt deposits located near Saltville, Virginia. Geologically, this area is quite unique in that this is the only known deposit of native rock salt to exist in the southern Appalachian Basin. The principal salt deposits occur in the Mississippian aged Maccrady formation and to a lesser extent in the overlying Mississippian Little Valley Formation. The salt-bearing formations, along with other enclosing sedimentary strata, have been drastically bent into a northeast-trending structure known as the overturned Greendale Syncline. Forces which caused the folding also created the paralleling Saltville Thrust Fault along which older Ordovician and Cambrian dolomites, shales, and limestones were pushed northwestward over the younger, deformed salt-bearing formations.

The forces that caused the Saltville Fault occurred during the Appalachian Orogeny 250-300 million years ago. Modern day earthquakes are not associated with this movement, and occur at much greater depths. Since this local seismic activity is not associated with the Saltville Fault, it should not present a hazard to

the construction and operation of the Class I-I and III-G wells in the Saltville area.

According to Martin Chapman with Virginia Polytechnic Institute, there has been no documentation of displacement along the Saltville fault occurring in the last 100,000 years. Bollinger and coworkers (1969, 1972) examined all available seismic data between 1758 and 1972 and found no evidence to indicate any earthquake activity associated with, or movement along, the Saltville thrust. James R. Craig, in the "Geologic Evaluation of the Saltville Area", states that "the Saltville thrust is now, has been for a long time, and will remain for a considerable time in the future, inactive and thus constitutes no direct threat to persons or edifices in the Saltville area".

A number of seismically active areas exist throughout Virginia and Tennessee, however, southwest Virginia is relatively quiet and earthquakes are not a major regional hazard. Only a few tremors large enough to record have occurred in modern history. Most local earthquakes are of magnitude 2.0-3.0. For example, in February of 1994, a 2.5 magnitude quake occurred with the epicenter between Bristol, Tennessee and Pulaski, Virginia. According to the California Department of Mines Division of Oil and Gas, no significant damage to well bores occurs due to earthquakes of this magnitude.

One of the largest regional seismic areas is the Eastern Tennessee

Seismic Zone which begins approximately 85 miles to the southwest of the project area. This zone is comprised of concentrated, northeasterly-trending seismic activity in eastern Tennessee, parts of North Carolina, and Georgia. Some quakes associated with this zone have been felt in portions of southwest Virginia. The zone trending NE-SW is aligned with the trend of the southern Appalachians. Both of the host provinces, the Valley and Ridge and the Blue Ridge, are thrust and fold complexes underlain by a master decollement with a maximum depth to the decollement of approximately 3 miles. Mean focal depth for seismic activity beneath the zone is approximately 9.4 miles. Thus, the vast majority of earthquakes occur in inferred Grenville-age, crystalline basement rocks and are not directly associated with the decollement or the overlying, detached sediment. As is generally the case in eastern North America, earthquakes within this zone cannot be attributed to known shallow faults but rather to strike-slip movement of deep-seated basement crustal blocks.

Another zone of seismic activity is found in the Giles County area 75 miles to the northeast. Again, seismic energy is released by strike-slip movement in autochthonous Grenville basement rocks.

Stringent casing programs will be followed in the injection wells to ensure adequate casing through the fault zone. This will diminish the possibility that injected fluids will enter the fault plane.

The proposed storage program will target the salt in the lower limb of the Maccrady Formation. The project will require the leaching of salt caverns using available fresh water and subsequently disposing of the resulting brine water, as well as brine from the existing cavern, by injection into deeper subsurface disposal wells.

The project will involve the following:

- \* Fresh water will be injected into solution wells to dissolve out salt caverns within the Maccrady formation.
- \* The extracted brine fluids will then be pumped into disposal wells for injection into the deeper Siluro-Devonian section of sedimentary rocks.

From the late 1700's until 1972, Saltville was a leading salt producer. Records beginning in 1900 state that over 28 million tons of salt have been produced; no records were kept prior to 1900. In order to extract the salt, numerous brine wells were drilled in the area, most of which were shallow low pressure wells. High pressure brine wells were drilled beginning in the 1930's. In these wells, fresh water was circulated down the casing and out into the open hole section in the Maccrady Formation. The salt was leached out and the resulting brine was then circulated up the casing annulus and down to the Olin plant as raw stock.

## **SALT ACCUMULATION**

The salt accumulation at Saltville, Virginia, was originally a bedded deposit which has since been structurally modified by compression and faulting associated with the Appalachian orogeny thus obscuring the character of the original deposit.

Available geologic data supports an estimate of approximately 500 acres of known salt with at least another 500 acres of probable salt to be developed (see attached map). This figure could ultimately prove to be very conservative and can only be verified by additional well control. Byron Cooper of Virginia Polytechnic Institute, who acted as geological supervisor for Olin Chemical's salt operations, made an attempt at salt reserve calculations in 1959. His best estimate was that the total salt tonnage present in the Saltville deposit exceeded 2 billion tons.

Estimates for actual past production prepared by Fenix and Scisson in a 1972 report shows the following:

### **SALT EXTRACTION FROM LOW PRESSURE FIELD**

<u>Years</u>	<u>Tons Extracted</u>
Prior to 1900	Unknown
1900-1932	6,132,000
1932-1941	2,874,375
1941-1952	2,710,125
1952-1972	<u>2,007,622</u>
Total	13,724,122 plus

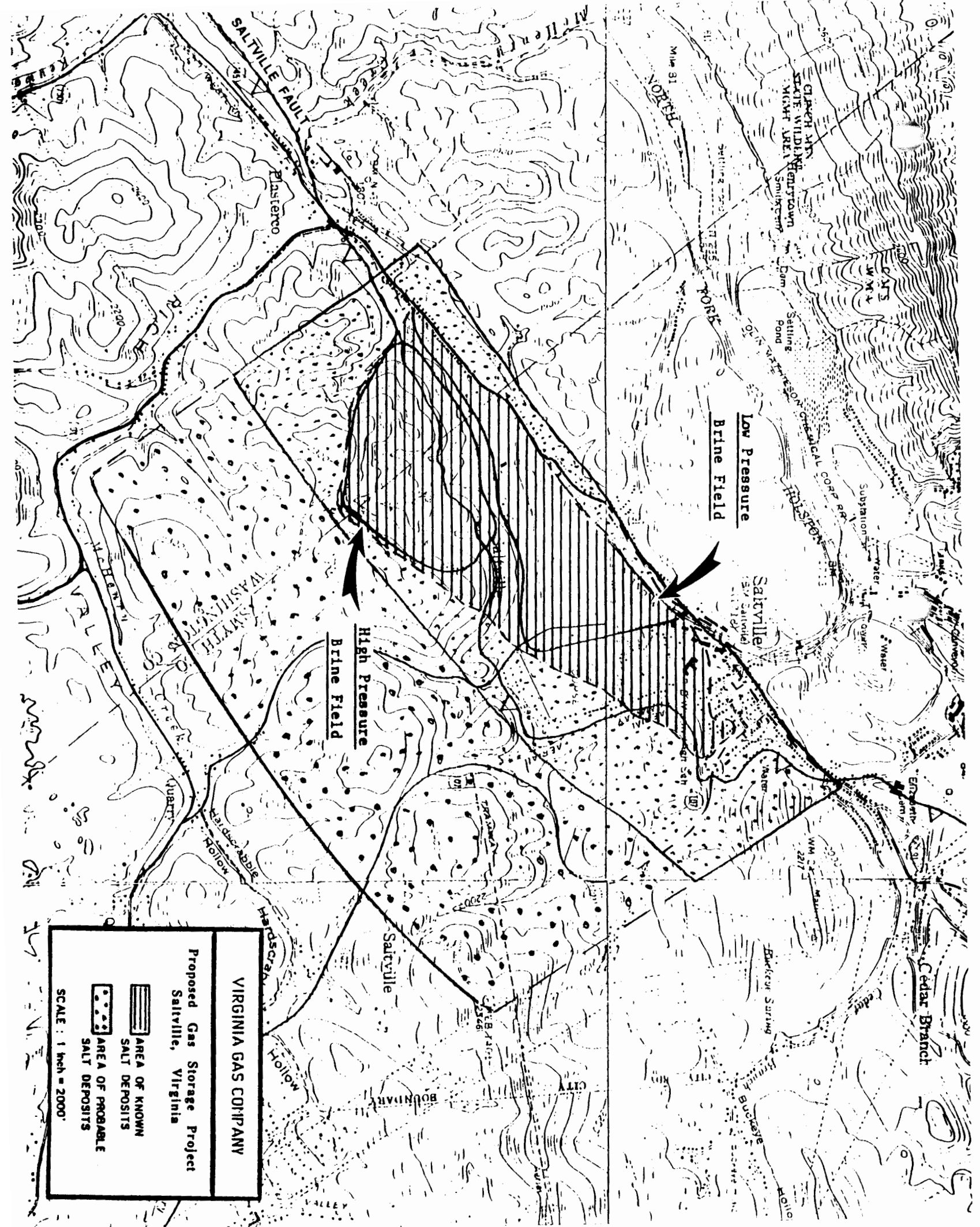
#### SALT EXTRACTION FROM HIGH PRESSURE FIELD

<u>Years</u>	<u>Tons Extracted</u>
1932-1941	958,125
1941-1952	2,710,125
1952-1972	<u>11,376,536</u>
Total	15,044,786

Grand Total Salt Extracted Since 1900 = 28,768,908 tons

It is doubtful that production prior to 1900 can close to this figure of approximately 30 million tons. Thus, if Cooper's estimate of 2 billion tons of salt is representative, then the Saltville deposit has barely been touched.

Below a depth of 1500 feet individual salt accumulations in excess of 150 feet thick are not uncommon. These individual bodies can range from a shale/salt intermix of 50 percent-50 percent to almost pure salt. Total net salt thicknesses have been encountered that easily exceed 500 feet.



## **BEDDED SALT CAVERN STORAGE**

In the United States, natural gas storage operations in caverns within bedded salt are conducted in Michigan. Here, the Battle creek Gas Company cycles gas from the Silurian "A-2" salt in Barry County while in St. Clair County, Southeastern Michigan Gas Company stores in the Silurian "B" salt. In New York State, activity is presently underway at two sites proposed for bedded Silurian salt solution storage projects. The Avoca project is located in Steuben County, while the Cayuta project is situated in Schuyler County.

Canadian bedded salt storage programs exist in both Alberta and Saskatchewan. Northwestern Utilities, Ltd. stores gas in a Devonian salt cavern in Stratheona County, Alberta. TransGas Ltd. operates five salt storage facilities in Saskatchewan which also utilizes Devonian salt beds. These operations are summarized in the following chart:

## SUMMARY SHEET

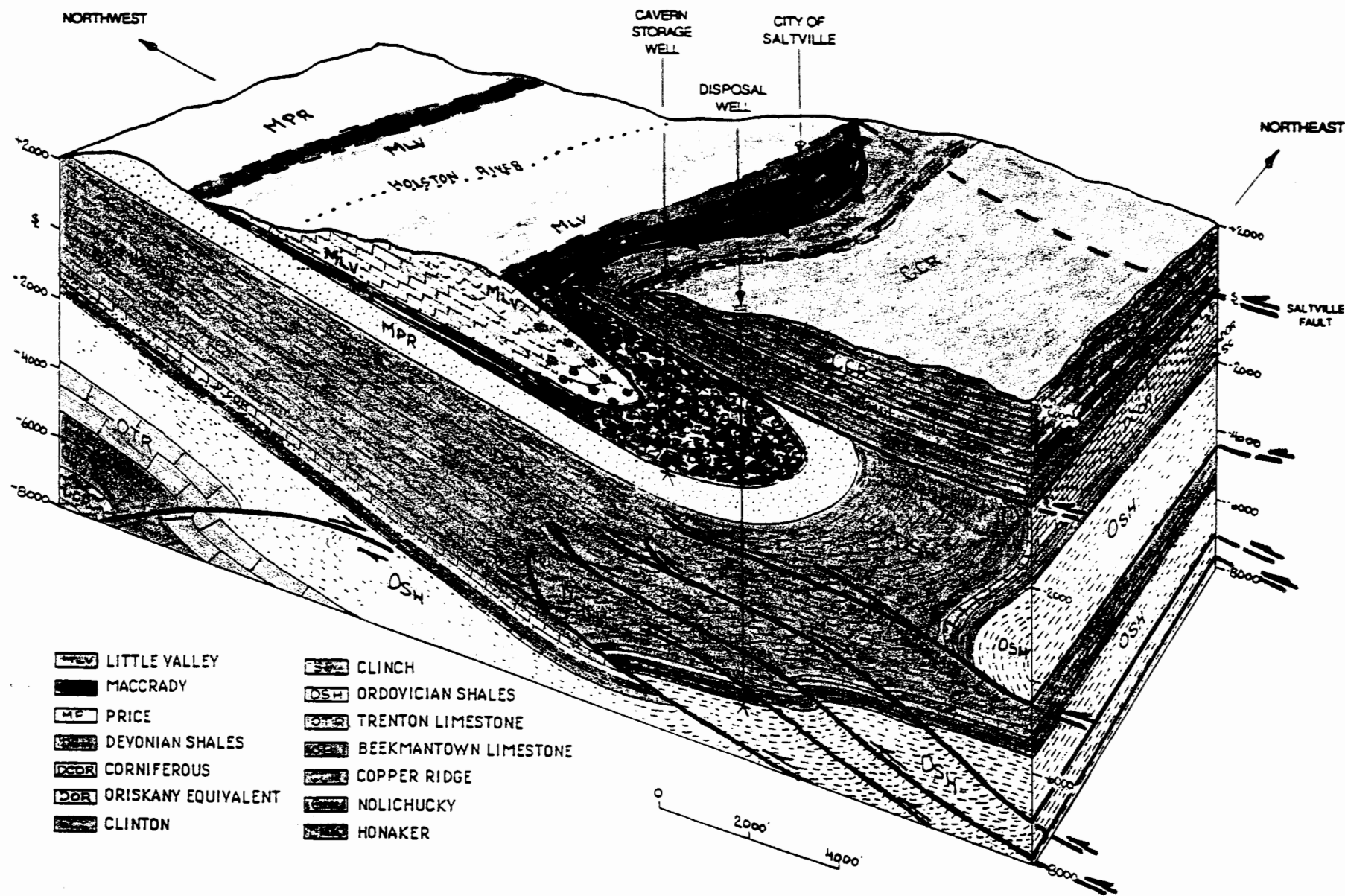
### NORTH AMERICA

#### Bedded Salt Cavern Storage

<u>State or Province</u>	<u>Operator</u>	<u>Year in Operation</u>	<u>Name &amp; Number of Caverns</u>	<u>Geol. Age</u>	<u>Total Volume*</u>
Michigan	Battle Creek Gas Co.	--	Lacey (1)	Sil.	238
Michigan	S.E. Mich. Gas Co.	1961	Morton (6)	Sil.	3,077
Alberta	N.W. Utilities	1984	Nul Caverns (1)	Dev.	5,046
Saskatchewan	Trans Gas	1976	Landis (1)	Dev.	2,228
	Trans Gas	1964	Melville (1)	Dev.	308
	Trans Gas	1993	Moosomin (1)	Dev.	--
	Trans Gas	1968	Prud Homme (1)	Dev.	3,014
	Trans Gas	1967	Regina (1)	Dev.	3,861
	Trans Gas	1992	Procor (1)	Dev.	1,993

\*Total of base gas plus working gas (MMCF).

# BLOCK DIAGRAM GEOLOGY OF SALTVILLE, VA



## REFERENCES

- Bollinger, G.A. ,1969, *Seismicity of the Central Appalachian States of Virginia, West Virginia, and Maryland-1758 through 1968*: Bull. Seis. Soc. Amer., 59:2103-2111.
- Bollinger, G.A. and M.G. Hopper,1972, *The Earthquake History of Virginia 1900-1970*: Virginia Polytechnic Institute and State University, Blacksburg, Virginia.
- Bollinger, G.A., M.S. Sibol, M.C. Chapman, J.A. Snoke, 1993, *Virginia Regional Seismic Network, Final Report (1986-1992)*, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.
- Campian, Jim, Personal communication, California Department of Mines, Division of Oil and Gas, July 24, 1995.
- Chapman, M.C., Personal communication, Professor at Virginia Polytechnic Institute and State University, July 31, 1995.
- Saltville Planning Commission and J.R. Craig, 1973, *Geologic Evaluation of the Saltville Area, Smyth County, Virginia*: Saltville Planning Commission

EVALUATION OF SUBSIDENCE POTENTIAL  
HIGH PRESSURE FIELD  
SALTVILLE, WASHINGTON/SMYTH COUNTY, VIRGINIA

Charles S. Bartlett, Ph.D.  
Chief Geologist

BARTLETT GEOLOGICAL CONSULTANTS  
586 EAST MAIN STREET  
ABINGDON, VA 24210

*Charles S. Bartlett*

DATE: March 24, 1994

TO: Mr. Mike Edwards  
Virginia Gas Company  
120 South Court Street  
Abingdon, VA 24210

RE: Evaluation of Subsidence Potential  
High Pressure Field  
Saltville, Washington/Smyth County, Virginia

#### Summary of Analysis

Following reconnaissance field exploration and examination of the well data, I have concluded that the potential for subsidence from the underground salt extraction is dependent upon two fairly obvious factors, first, the thickness of the competent dolomites, limestones, and shales above the Saltville thrust fault, and, secondly, the depth of salt extraction in the underlying Maccrady Formation.

Considering all of these factors and the topography, I have prepared a summary diagram which is a residual map showing the known and projected thickness of overlying rocks above the Saltville thrust, which somewhat mimics the topography. Since no surface evidence of subsidence was found in the area examined at or south of the outcrop belt of the Nolichucky Formation, it can be concluded that the potential for subsidence is significantly lessened in the areas where the overburden is as much as 600 ft. thick, or more. This includes the areas at and south of Wells #9, 17, 16, and 20.

Page Two

#### Method of Study

I have drawn on extensive past knowledge of the stratigraphy in the Saltville area and was able to easily recognize, when outcrops were present, the distinctions between the primary formations of concern, those being the Honaker Dolomite, Nolichucky Formation, and Copper Ridge Formation, in ascending stratigraphic order.

Previously, I had examined exposures along Route 107, between Chilhowie and Saltville, and Route 91, between Glade Spring and Plasterco. On one earlier occasion, I also did a surface examination of a portion of the area south of Saltville and west of the quarry road, County Route #610, at which time I viewed some of the subsidence features, especially those on the north slope of the ridge and close to the Saltville Fault, where Honaker Dolomite was deeply and extensively broken.

On March 15th, in the company of three Virginia Gas Company employees, we examined portions of the area at and to the south of the high pressure salt wells. Primarily, I followed along the outcrop belt of the Nolichucky Formation, which consists of shales with interbedded thin to medium layers of fossiliferous limestone. Along this traverse, which is on the steep north slope of the Chestnut Ridge, we found no evidence of fracturing of this formation which could be attributed to subsidence.

Page Three

#### Subsurface Study

Exhibit A is a composite of data, partly supplied by the Virginia Gas office and particularly, Mr. Jim Wilson. Well locations were plotted. Depths to the Saltville Fault were noted, and from that, the structural position of the Saltville Fault was determined and projected.

Although some areas have concentrated information, this data is a bit suspect as to its total accuracy. This is apparent when the contour of the Saltville Fault was prepared from these data points. However, generally, the information is consistent with only rare exceptions, such as Well #4, which appears to be abnormally low in elevation of the Saltville Fault. Without concentrated control points on the fault penetration, it is assumed that the fault is in the form of a southeastward dipping plane, although there may be some irregularities in that configuration.

The next step was to overlay the Saltville Fault plane contour on the topographic map in order to prepare the final residual map which indicates the approximate thickness to the Saltville Fault across the map area. Naturally, this contouring somewhat mimics a topographic form but is somewhat subdued.

The northeast-southwest trending ridgeline, rising to the south of most of the high pressure wells, would apparently be an extension of Chestnut Ridge. For purposes of identification, I have labelled the higher knobs from northeast to southwest with a lettering from "A" to "D". Hill promitories in Smyth County

Page Four

are labelled "A" and "B". Hill promitories in Washington County are labelled "C" and "D". The Confederate Civil War revetments are located on Hills "B" and "D". Hill D also presently is occupied by a somewhat dilapidated cemetery.

#### Subsidence Evidence

Along most of this line of hills, the thickness to the Saltville Fault ranges from 800 to 900 ft. with intervening valleys or gaps being somewhat less. Previous field observations show major subsidence, which is quite obvious, in the vicinity of Wells 1-4 and just south of the northern overthrust edge in the vicinity and to the north of the area of Wells 13, 14, and 16. No field examination has been made of Wells 23-28, but I suspect some fracturing would be evident in the Honaker Dolomite for that area. Mr. Wilson provided me with subsurface data on the extraction of the salt, and it is notable that Wells 1-4 produced their salt from a much shallower depth than Wells 16 and 20.

Two factors created the instability in the area of Wells 1-4. The thickness of the overthrust sheet ranges from only 200 to 316 ft. In this area, the upper part of the Maccrady was the target for the salt extraction. Thus, the subsidence of the cavern formed by salt extraction soon rose to the position of the Saltville thrust sheet and, with only approximately 300 ft. of competent beds above, the created cavern finally resulted in the collapse above that area in 1960.

Page Five

In the area of Wells 16 and 20, the depth to the fault is at or slightly over 900 ft. In these two wells, the salt was extracted from the lower portions of the Maccrady Formation and the created cavern has probably bridged over and partly stabilized within the Maccrady. Even should this area sag further, all the way to the top of the Maccrady and just beneath the Saltville Fault, there should be sufficient thickness of competent beds above the fault to maintain this bridging and reduce the probability of collapse or fracturing to a bare minimum.

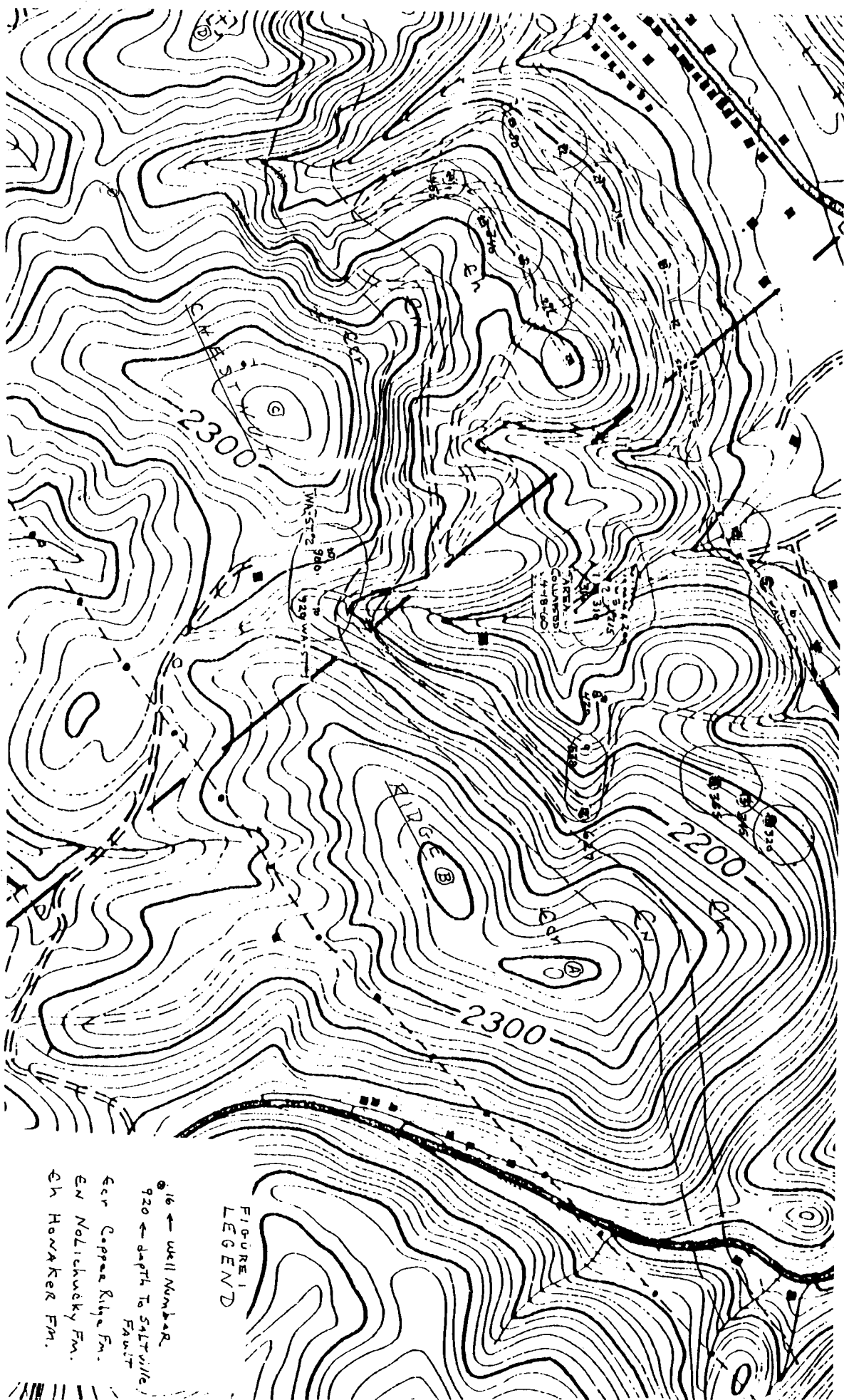
#### Conclusions

While there are no absolutes in predicting subsidence, it does appear from the field and subsurface data that a very high probability of stability should be anticipated in areas at or south of Wells 9, 17, 16, and 20.

Since no subsidence evidence was seen in the field along the outcrop belt of the Nolichucky Formation or south of that shale unit, it would appear that that is a fairly safe area for planning purposes.

As a further safeguard, I would suggest that no salt be extracted in the upper 1000 ft. of Maccrady shale below the Saltville Fault, if at all possible. A final additional safeguard would be to attempt to space any cavern creation so that the caverns do not link up and increase the instability above them.

A handwritten signature in black ink, appearing to read "Charles S. Gault" followed by a stylized monogram or set of initials.



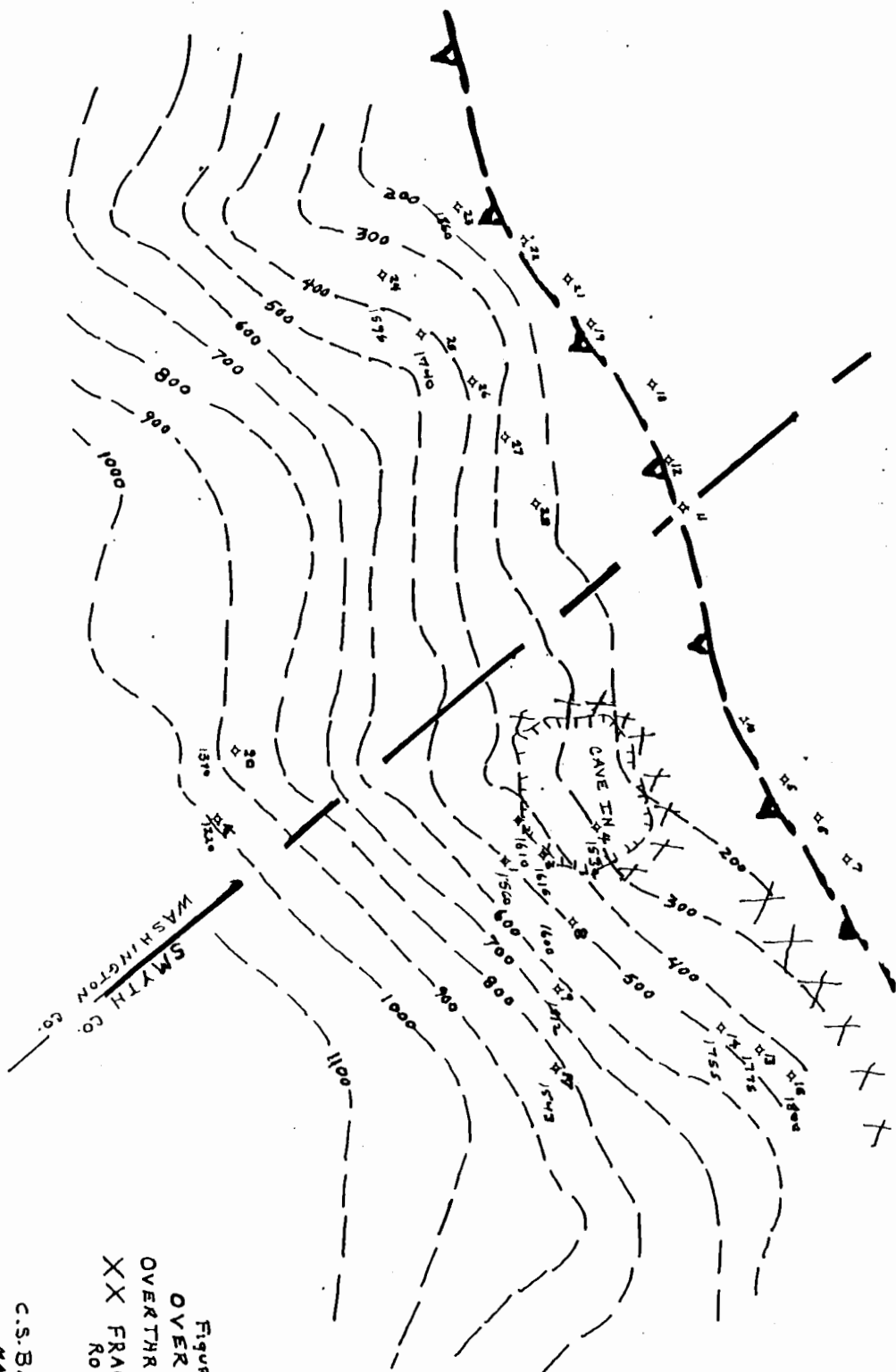


Figure 1  
OVERLAY  
OVERTHRUST THICKNESS  
XX FRACTURED  
ROCKS

C.S. BARTLETT  
MARCH 1994

**FORM 4**  
**ATTACHMENT H**  
**OPERATING DATA**

## **FORM 4**

### **ATTACHMENT H**

#### **OPERATING DATA - CLASS I-I WELLS**

VGC is proposing to drill up to three Class I-I wells for the disposal of salt water brine. Approximately 1.5 million barrels of brine from the existing CH-16 and CH-20 wells and approximately 9,000,000 barrels of brine created from leaching new caverns are anticipated to be injected over the life of the storage project.

The average daily volume of salt water brine to be injected is estimated to be 960 barrels (40,320 gallons) per day. This is based on injecting fluid at a rate of 1 barrel (42 gallons) per minute for 16 hours a day. The maximum daily volume of fluids injected is estimated to be 3,450 barrels (144,900 gallons) per day. The maximum daily rate of fluid injection is based on injecting at a rate of 2.5 barrels (105 gallons) per minute for 23 hours per day. Actual volumes and rates will be dependent upon the allowable operating pressure of the wells.

An analysis of the constituents of the brine contained in the existing cavern is attached. Analysis of the brine resulting from the solution process of creating natural gas storage cavities (Class III-G wells) is not available at this time since operations on these wells has not yet begun. However, the anticipated salinity will be much less than in the CH-16 and CH-20. The salt water brine in the existing caverns is at saturation. The

water used to leach any new caverns will need to have a low salinity in order for the leaching process to work efficiently. Once the solution process begins, the resulting brine will be analyzed and the results submitted.

Information regarding the average and maximum operating pressures as measured at the surface will be dependent upon the analysis of the brine and the results of the formation testing program.

## **OPERATING DATA - CLASS III-G WELLS**

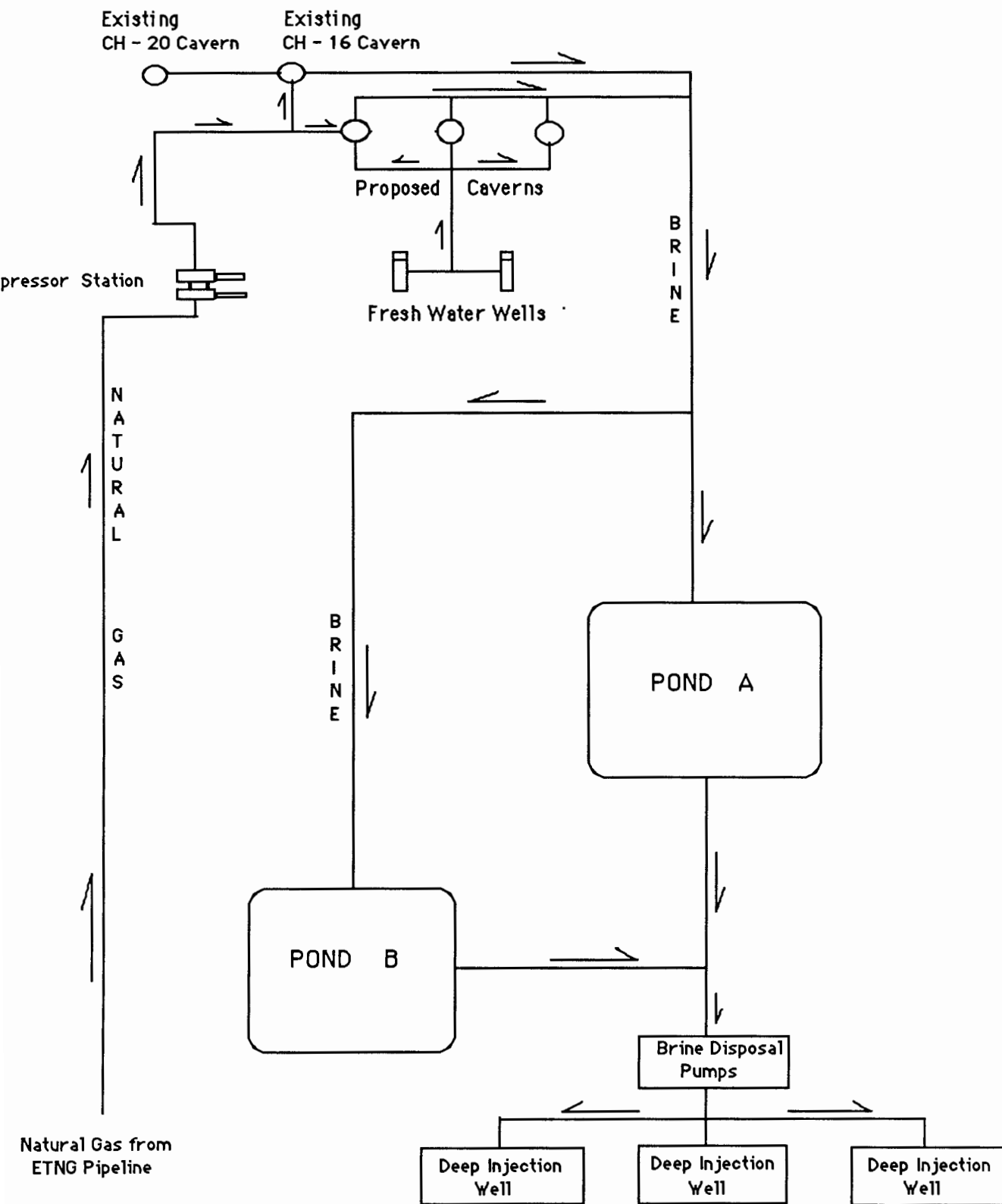
Up to three Class III-G wells are proposed for the creation of caverns in which to store natural gas. This will involve leaching caverns from salt formations using approximately 3,000,000 barrels of water per cavern.

The average daily volume of fresh water to be injected is estimated to be 5,000 barrels (210,000 gallons) per day. This is based on injecting fluid at a rate of 3.47 barrels (146 gallons) per minute for 24 hours a day. The maximum daily volume of fresh water to be injected is estimated to be 10,000 barrels (420,000 gallons) per day. The maximum daily rate of fluid injection is based on injecting at a rate of 6.94 barrels (292 gallons) per minute for 24 hours per day.

An analysis of the fresh water is not available at this time because the injected fluid will be from water wells drilled near the natural gas

storage cavities (Class III-G Wells). Once the water wells are drilled and cased, the local ground water will be tested and the results submitted as part of this application.

Information regarding the average and maximum operating pressures as measured at the surface is not available at this time since it will be dependent upon the analysis of the fresh water which is circulated into the well and the brine fluid being circulated out of the well, taking into account the resulting differences in specific gravity and pipe friction pressures.



FLOW DIAGRAM FOR SALTVILLE NATURAL GAS STORAGE FACILITY

7/18/95



# ENVIRONMENTAL MONITORING, INCORPORATED

ENVIRONMENTAL CONSULTANTS ▲ ANALYTICAL LABORATORIES  
P.O. BOX 1477 ▲ COEBURN, VIRGINIA 24230 ▲ 703/395-3661  
966 W. MAIN ST., SUITE 1 ▲ ABINGDON, VIRGINIA 24210 ▲ 703/676-4586

## CERTIFICATE OF ANALYSIS

VIRGINIA GAS COMPANY  
P.O. BOX 2407  
ABINGDON, VA 24210

REPORT DATE: 05/10/95  
PROJECT: 213.121  
SITE: CH-16/SALTVILLE  
COLLECTED BY: R. YEARY  
EMI #: 950502-02-A  
ANALYZED BY: EMI

DATE COLLECTED: 05/02/95  
DATE RECEIVED: 05/02/95

SAMPLE IDENTIFICATION: CH-16 \*

<u>PARAMETER</u>	<u>DATE ANALYZED</u>	<u>METHOD</u>	<u>UNITS</u>	<u>RESULT</u>
CHLORIDE	05/03/95	SW846(9252)	PPM	>95,000
CONDUCTIVITY	05/03/95	EPA 120.1	PPM	>260,000
MERCURY	05/03/95	EPA 245.1	PPM	0.0004
PH	05/02/95	EPA 150.1	STD.	9.1
SPECIFIC GRAVITY	05/03/95	-	-	1.21
SOLIDS	05/03/95	EPA 160.1	PPM	>290,000

MATRIX: AQUEOUS

Accuracy of analytical results were affected by sample composition.

THE BEST OF MY KNOWLEDGE AND BELIEF THE ABOVE RESULTS WERE OBTAINED BY ACCEPTED ANALYTICAL  
PROCEDURES AND ARE SUBMITTED FOR ENVIRONMENTAL MONITORING, INCORPORATED.

By: M. L. Beach



# ENVIRONMENTAL MONITORING, INCORPORATED

ENVIRONMENTAL CONSULTANTS ▲ ANALYTICAL LABORATORIES  
P.O. BOX 1477 ▲ COEBURN, VIRGINIA 24230 ▲ 703/395-3661  
966 W. MAIN ST., SUITE 1 ▲ ABINGDON, VIRGINIA 24210 ▲ 703/676-4586

## CERTIFICATE OF ANALYSIS

VIRGINIA GAS COMPANY  
P.O. BOX 2407  
ABINGDON, VA 24210

REPORT DATE: 05/04/95  
PROJECT: 213.121  
SITE: CH-16  
COLLECTED BY: DAVID PORTER  
EMI #: 950428-03-A  
ANALYZED BY: EMI

DATE COLLECTED: 04/28/95  
DATE RECEIVED: 04/28/95

SAMPLE IDENTIFICATION: CH-16 \*

<u>PARAMETER</u>	<u>DATE ANALYZED</u>	<u>METHOD</u>	<u>UNITS</u>	<u>RESULT</u>
FLORIDE	05/01/95	SW846(9252)	PPM	>300,000
DUCTIVITY	04/28/95	EPA 120.1	PPM	>280,000
ERCURY	05/03/95	EPA 245.1	PPM	0.0004
I	04/28/95	EPA 150.1	STD.	9.6
PECIFIC GRAVITY	05/01/95	-	-	1.20
OS	05/01/95	EPA 160.1	PPM	>220,000

ATRIX: AQUEOUS

Accuracy of analytical results were affected by sample composition.

BEST OF MY KNOWLEDGE AND BELIEF THE ABOVE RESULTS WERE OBTAINED BY ACCEPTED ANALYTICAL  
DURES AND ARE SUBMITTED FOR ENVIRONMENTAL MONITORING, INCORPORATED. *My*

By: *M. L. Beards*



# ENVIRONMENTAL MONITORING, INCORPORATED

ENVIRONMENTAL CONSULTANTS ▲ ANALYTICAL LABORATORIES  
P.O. BOX 1477 ▲ COEBURN, VIRGINIA 24230 ▲ 703/395-3661  
966 W. MAIN ST., SUITE 1 ▲ ABINGDON, VIRGINIA 24210 ▲ 703/676-4586

## CERTIFICATE OF ANALYSIS

VIRGINIA GAS COMPANY  
PO BOX 2407  
ABINGDON, VA 24210

REPORT DATE: 05/04/95  
PROJECT: 213.121  
SITE: CH-16/SALTVILLE  
COLLECTED BY: F. MERENDINO  
EMI #: 950428-04-C  
ANALYZED BY: EMI

DATE COLLECTED: 04/27/95  
DATE RECEIVED: 04/27/95

SAMPLE IDENTIFICATION: SAMPLE #3 CH-16 \*

<u>PARAMETER</u>	<u>DATE ANALYZED</u>	<u>METHOD</u>	<u>UNITS</u>	<u>RESULT</u>
Chloride	05/01/95	SW846(9252)	PPM	>300,000
Conductivity	04/28/95	EPA 120.1	PPM	83,000
pH	04/28/95	EPA 150.1	STD.	8.8
Specific Gravity	05/01/95	-	-	1.20
TDS	05/01/95	EPA 160.1	PPM	>170,000

MATRIX: Aqueous

Accuracy of analytical results were affected by sample composition.

THE BEST OF MY KNOWLEDGE AND BELIEF THE ABOVE RESULTS WERE OBTAINED BY ACCEPTED ANALYTICAL  
PROCEDURES AND ARE SUBMITTED FOR ENVIRONMENTAL MONITORING, INCORPORATED. *MM*

By: *MM*



# ENVIRONMENTAL MONITORING, INCORPORATED

ENVIRONMENTAL CONSULTANTS ▲ ANALYTICAL LABORATORIES

P.O. BOX 1477 ▲ COEBURN, VIRGINIA 24230 ▲ 703/395-3661

## CERTIFICATE OF ANALYSIS

VIRGINIA GAS COMPANY  
PO BOX 2407  
ABINGDON, VA 24210

REPORT DATE: 05/04/95  
PROJECT: 213.121  
SITE: CH-16/SALTVILLE  
COLLECTED BY: F. MERENDINO  
EMI #: 950428-04-B  
ANALYZED BY: EMI

DATE COLLECTED: 04/27/95  
DATE RECEIVED: 04/27/95

SAMPLE IDENTIFICATION: SAMPLE #2 CH-16 (FLOWBACK) CLEAR BRINE \*

<u>PARAMETER</u>	<u>DATE ANALYZED</u>	<u>METHOD</u>	<u>UNITS</u>	<u>RESULT</u>
Chloride	05/01/95	SW846(9252)	PPM	280,000
Conductivity	04/28/95	EPA 120.1	PPM	84,000
pH	04/28/95	EPA 150.1	STD.	10.7
Specific Gravity	05/01/95	-	-	1.20
TDS	05/01/95	EPA 160.1	PPM	247600 **

MATRIX: Aqueous

\* Accuracy of analytical results were affected by sample composition.

\*\* ± 20%

best of my knowledge and belief the above results were obtained by accepted analytical procedures and are submitted for Environmental Monitoring, Incorporated. Cc

Officer GREG KEETON

Lab Manager M. B. Smith



# ENVIRONMENTAL MONITORING INCORPORATED

ENVIRONMENTAL CONSULTANTS ▲ ANALYTICAL LABORATORIES

P.O. BOX 1477 ▲ COEBURN, VIRGINIA 24230 ▲ 703/395-3661

## CERTIFICATE OF ANALYSIS

VIRGINIA GAS COMPANY  
PO BOX 2407  
ABINGDON, VA 24210

REPORT DATE: 07/11/95  
SITE ID: SALTVILLE GAS STORAGE  
BRINE WATER  
PROJECT: 213.122  
COLLECTED BY: J. ATKINS  
EMI #: 950630-03-A  
ANALYZED BY: EMI

DATE RECEIVED: 06/30/95  
DATE EXTRACTED: 06/30/95  
DATE ANALYZED: 07/06-10/95

SAMPLE ID: GSBW-01

### TOTAL METALS

<u>ELEMENT</u>	<u>DL (mg/l)</u>	<u>RESULT (mg/l)</u>
Arsenic	1.1	BDL
Barium	0.1	3.0
Cadmium	0.4	BDL
Chromium	1.1	15.6
Lead	1.0	BDL
Mercury	0.03	BDL
Selenium	1.1	BDL
Silver	0.8	BDL

MATRIX: Aqueous

DL - Detection Limit  
BDL - Below Detection Limit

Method: Mercury - EPA 245.1  
Other Metals - SW 846 (6010)

Best of my knowledge and belief the above results were obtained by accepted analytical procedures and are submitted for Environmental Monitoring, Incorporated.

Officer *Sup. Nelson*

Lab Manager *M. B. Smith*



# ENVIRONMENTAL MONITORING INCORPORATED

ENVIRONMENTAL CONSULTANTS ▲ ANALYTICAL LABORATORIES

P.O. BOX 1477 ▲ COEBURN, VIRGINIA 24230 ▲ 703/395-3661

## CERTIFICATE OF ANALYSIS

VIRGINIA GAS COMPANY  
PO BOX 2407  
ABINGDON, VA 24210

REPORT DATE: 07/11/95  
SITE ID: SALTVILLE GAS STORAGE  
BRINE WATER  
PROJECT: 213.122  
COLLECTED BY: JOEY ATKINS  
EMI #: 950705-01-A  
ANALYZED BY: EMI

DATE COLLECTED: 07/03/95  
DATE RECEIVED: 07/05/95  
DATE ANALYZED: 07/10/95

SAMPLE IDENTIFICATION: GSBW-02

<u>PARAMETER</u>	<u>MDL (PPB)</u>	<u>RESULT (PPB)</u>
BENZENE	17	BDL
TOLUENE	17	BDL
ETHYL BENZENE	14	BDL
TOTAL XYLENES	28	BDL

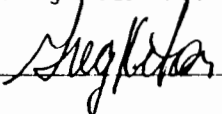
<u>PARAMETER</u>	<u>% RECOVERY</u>
1,2-Dichloroethane-d4	102
Toulene-d8	101
Bromofluorobenzene	103

MATRIX: AQUEOUS

MDL - METHOD DETECTION LIMIT  
BDL - BELOW DETECTION LIMIT

METHOD: EPA 5030, 8260A

est of my knowledge and belief the above results were obtained by accepted analytical procedures and are submitted for Environmental Monitoring, Incorporated.

Officer 

Lab Manager 

**FORM 4**  
**ATTACHMENT I**

**FORMATION TESTING PROGRAM**

## **FORM 4**

### **ATTACHMENT I**

#### **FORMATION TESTING PROGRAM**

A request to conduct a formation testing program and mechanical integrity testing program will be submitted, along with any and all available stimulation data conducted on the wells, to the U.S. Environmental Protection Agency.

**FORM 4**  
**ATTACHMENT J**

**STIMULATION PROGRAM**

## **FORM 4**

### **ATTACHMENT J**

#### **STIMULATION PROGRAM**

Within the Project Area, up to three exploratory gas wells will be drilled to determine the natural gas potential of the area. As part of the normal completion activities, these wells will be stimulated utilizing accepted stimulation techniques with gelled water or foam-based fluids and 60,000 to 120,000 lbs or more of sand. In the event that the completion work is unsuccessful on these wells, it is proposed to convert them into Class 1-I Disposal Wells. A complete description of the actual stimulation program will then be submitted as a part of this application.

No wells drilled or converted into Class III-G wells will be stimulated.

**FORM 4**  
**ATTACHMENT K**  
**INJECTION PROCEDURES**

## **FORM 4**

### **ATTACHMENT K**

#### **INJECTION PROCEDURES**

Fresh water will be withdrawn from water wells which will be drilled in close proximity to the Class III-G wells and completed in the Upper Cambrian and Ordovician dolomites. The water will be pumped through a pipeline and into the test holes which will be completed open hole. The fresh water will travel down into the 7" string of pipe (wash string) and out into the open hole where leaching of the salt beds occur. As water dissolves the salt, a cavity will be created. Approximately 300,000 barrels of space will be leached per cavity to obtain 214,000 barrels of working gas storage. It has been estimated that ten barrels of water will be needed to leach one barrel of salt. Therefore, 3,000,000 barrels of water will be needed to create the 300,000 barrel cavity described above. The resulting brine will then be circulated back out of the well through the 4 1/2" work string. Return flow lines will then transport the fluid into brine holding ponds. The caverns will be spaced approximately 800' to 1000' or greater, apart to prevent their coalescence.

Brine from the existing CH-16 and CH-20 will also be injected into the Class I-I disposal well. Approximately 1.5 million barrels of brine are contained in the cavern. Phase I of the project will involve debrining 600,000 barrels from the cavern into the holding ponds to be injected.

From these brine holding ponds, the fluid will be pumped through a series of in-line filters and a chemical biocide will be added. Pumps will then transfer and displace the treated brine fluid to the Class 1-I wells where pressure, rates, and volumes will be monitored immediately downstream of the injection pumps. The fluid will travel down the tubing, through the perforations in the casing and into the receiving formations.

**FORM 4**  
**ATTACHMENT L**

**CONSTRUCTION PROCEDURES**

## FORM 4

### ATTACHMENT L

#### CONSTRUCTION PROCEDURES

##### A. Proposed Casing and Cementing Data - Cavern Wells

Conductor	± 40'	24" O.D. ; ST&C	Cement to Surface
Surface Casing	± 600'	16"; 75#/ft. ; ST&C	Cement to Surface
Water Protection	±1500'	13 3/8"; 54.5#/ft.; ST&C	Cement to Surface
Intermediate	± 3400'	9 5/8"; 40#/ft.; LT&C	Cement to Surface
Work String	± 4100'	7"; 26#/ft.; LT&C	
Work String	± 4100'	4 1/2"; 11.6#/ft.; ST&C	

##### B. Proposed Casing and Cementing Data - Disposal Wells

Conductor	± 20'	27" O.D.; ST&C	Cemented to Surface
Surface Casing	± 500'	22"; 114.8#/ft.; XLF	Cemented to Surface
Water Protection	± 1500'	16"; 75#/ft.; LT&C	Cemented to Surface
Intermediate*	± 2750'	11 3/4"; 54#/ft. LT&C	Cemented into 16"
Intermediate	± 4000'	8 5/8"; 32#/ft.; LT&C	Cemented into 11 3/4"
Long String	± 8750'	4 1/2"; 11.6#/ft.; ST&C	Cemented into 8 5/8"

##### C. Proposed Injection Tubing and Packer - Disposal Wells

Tubing	± 4500'	2 3/8"; 4.6#/ft. Reg.	On Packer
Packer	± 4450'	Make and Model Not determined at this time	

##### D. Proposed Logging Program - All Wells

Open Hole Logs -	GR/DEN/TEMP/DIL/NEU
Cased Hole Logs -	GR/CCL/CBL

##### E. Proposed Deviation Survey Data - All Wells

Survey shot points will begin at not greater than 200' depth and will be taken at distances of not greater than 200' apart from surface to the setting of the Water Protection String.

\*Optional casing string - may not run.

**Virginia Gas Company  
Proposed Cementing Program  
Deep Test Wells**

2/8/95

AWM

<b>Well Data:</b>	Conductor Pipe	<b>Cement System:</b>	Standard, 4% CaCl <sub>2</sub>
<b>Casing Size:</b>	27" O.D.	<b>Slurry Weight:</b>	15.6 lb./gal
<b>Open Hole:</b>	28"	<b>Slurry Yield:</b>	1.20 ft. <sup>3</sup> /sk.
<b>Depth:</b>	20'	<b>Cement Needed:</b>	10 Sacks
<b>Volume Factor:</b>	.2999 ft. <sup>3</sup> /ft.		
<b>Annular Volume:</b>	6 ft. <sup>3</sup>		
<b>W/100 % Excess Volume:</b>	12 ft. <sup>3</sup>		
<b>Well Data:</b>	Surface Pipe	<b>Cement System:</b>	Standard, 3% CaCl <sub>2</sub> 1/4 lb./sk. Flake
<b>Casing Size*:</b>	22", 114.8 lb./ft.		
*22" x .500" ; X-56 Grade; XLF Pipe		<b>Slurry Weight:</b>	15.6 lb./gal.
<b>Open Hole:</b>	26"	<b>Slurry Yield:</b>	1.20 ft. <sup>3</sup> /sk.
<b>Depth:</b>	500'	<b>Cement Needed:</b>	437 Sacks
<b>Volume Factor:</b>	1.0472 ft. <sup>3</sup> /ft.	<b>W/ 100% Excess Vol:</b>	874 Sacks
<b>Annular Volume:</b>	524 ft. <sup>3</sup>	Hole conditions will dictate % excess required.	
<b>W/ 100% Excess Volume:</b>	1048 ft. <sup>3</sup>		
<b>Well Data:</b>	Water Protection Casing	<b>Lead -in System:</b>	Standard, 6% Gel, 1/8#/sk. Flake
<b>Casing Size:</b>	16", 75 lb./ft.	<b>Slurry Weight:</b>	13.7 lb./gal.
<b>Open Hole:</b>	20"	<b>Slurry Yield:</b>	1.69 ft. <sup>3</sup> /sk.
<b>Depth:</b>	1500'	<b>Fillup Needed:</b>	1000 ft.
		<b>Cement Needed:</b>	664 Sacks (1122 ft. <sup>3</sup> )
<b>Vol. Factor (Open Hole):</b>	.7854 ft. <sup>3</sup> /ft.	<b>Tail-in System:</b>	Standard, 1% CaCl <sub>2</sub> 1/4 lb./sk. Flake
<b>Vol. Factor (In 22" Csg)</b>	1.0089 ft. <sup>3</sup> /ft.	<b>Slurry Weight:</b>	15.6 lb./gal.
<b>Annular Volume</b>	1,402 ft. <sup>3</sup>	<b>Slurry Yield:</b>	1.18 ft. <sup>3</sup> /sk.
		<b>Fillup Needed:</b>	500 ft.
<b>W/ 25% Excess Volume:</b>	1,752 ft. <sup>3</sup>	<b>Cement Needed:</b>	534 Sacks (630 ft. <sup>3</sup> )

**Virginia Gas Company  
Proposed Cementing Program  
Deep Test Wells**

2/8/95

<b>Well Data:</b>	1st Intermediate (Optional - hole conditions will dictate)	<b>Lead -in System:</b>	Standard, 6% Gel, 1/8#/sk. Flake
<b>Casing Size:</b>	11 3/4", 54 lb./ft.	<b>Slurry Weight:</b>	13.7 lb./gal.
<b>Open Hole:</b>	15"	<b>Slurry Yield:</b>	1.69 ft.3/sk.
<b>Depth:</b>	2750'	<b>Fillup Needed:</b>	1250 ft.
<b>Vol. Factor (Open Hole):</b>	.4741 ft.3/ft.	<b>Cement Needed:</b>	446 Sacks (754 ft.3)
<b>Vol. Factor (In 16" Csg)</b>	.4946 ft.3/ft.	<b>Tail-in System:</b>	Standard, 1% Cacl2 1/4 lb./sk. Flake
<b>Fillup Needed:</b>	1750'	<b>Slurry Weight:</b>	15.6 lb./gal.
<b>Annular Volume</b>	840 ft.3	<b>Slurry Yield:</b>	1.18 ft.3/sk.
<b>W/ 25% Excess Volume:</b>	1,050 ft.3	<b>Fillup Needed:</b>	500 ft.
		<b>Cement Needed:</b>	251 Sacks. (296 ft.3)
<b>Well Data:</b>	2nd Intermediate	<b>Lead -in System:</b>	Standard, 6% Gel, 1/8#/sk. Flake
<b>Casing Size:</b>	8 5/8", 32 lb./ft.	<b>Slurry Weight:</b>	13.7 lb./gal.
<b>Open Hole:</b>	11"	<b>Slurry Yield:</b>	1.69 ft.3/sk.
<b>Depth:</b>	4000'	<b>Fillup Needed:</b>	1250 ft.
<b>Vol. Factor (Open Hole):</b>	.2542 ft.3/ft.	<b>Cement Needed:</b>	275 Sacks (464 ft.3)
<b>Vol. Factor (11 3/4")</b>	.2399 ft.3/ft.	<b>Tail-in System:</b>	Standard, 1% CaCl2, .4 lb/sk. Halad 322, 1/8 lb./sk. Flake
<b>Fillup Needed:</b>	2000'	<b>Slurry Weight:</b>	15.6 lb./gal.
<b>Annular Volume</b>	498 ft.3	<b>Slurry Yield:</b>	1.18 ft.3/sk.
<b>W/ 25% Excess Volume:</b>	623 ft.3	<b>Fillup Needed:</b>	500 ft.
		<b>Cement Needed:</b>	135 Sacks. (159 ft.3)
<b>Well Data:</b>	Production Casing	<b>Vol. Factor (Open Hole):</b>	.2279 ft.3/ft.
<b>Casing Size:</b>	4 1/2", 11.6 lb./ft.	<b>Vol. Factor (8 5/8")</b>	.2235 ft.3/ft.
<b>Depth:</b>	8750'	<b>W/ 20% Excess Volume:</b>	1434 ft.3
<b>Fillup Needed:</b>	5250' (500' into 8 5/8")	<b>Lead-in System:</b>	Unknown at this time
<b>BHST:</b>	130 °F (estimated)		
<b>BHCT:</b>	110 °F (estimated)	<b>Tail-In System:</b>	Unknown at this time
<b>Circulating Media:</b>	Drilling Mud (water based)		

**Virginia Gas Company  
Proposed Cementing Program  
Cavern Wells**

2/8/95  
AWM

<b>Well Data:</b>	Conductor Pipe	<b>Cement System:</b>	Standard, 4% CaCl <sub>2</sub>
<b>Casing Size:</b>	24" O.D.	<b>Slurry Weight:</b>	15.6 lb./gal
<b>Open Hole:</b>	28"	<b>Slurry Yield:</b>	1.20 ft.3/sk.
<b>Depth:</b>	40'	<b>Cement Needed:</b>	75 Sacks
<b>Volume Factor:</b>	1.1344 ft.3/ft.		
<b>Annular Volume:</b>	45 ft.3		
<b>W/100 % Excess Volume:</b>	90 ft.3		
<b>Well Data:</b>	Surface Casing	<b>Cement System:</b>	Standard, 3% CaCl <sub>2</sub> 1/4 lb./sk. Flake
<b>Casing Size*:</b>	16", 75 lb./ft.	<b>Slurry Weight:</b>	15.6 lb./gal.
<b>Open Hole:</b>	20"	<b>Slurry Yield:</b>	1.20 ft.3/sk.
<b>Depth:</b>	600'	<b>Cement Needed:</b>	393 Sacks
<b>Volume Factor:</b>	.7854 ft.3/ft.	<b>W/ 100% Excess Vol:</b>	785 Sacks
<b>Annular Volume:</b>	471 ft.3	Hole conditions will dictate % excess required.	
<b>W/ 100% Excess Volume:</b>	942 ft.3		
<b>Well Data:</b>	Water Protection Casing	<b>Lead -in System:</b>	Standard, 6% Gel, 1/8#/sk. Flake
<b>Casing Size:</b>	13 3/8", 54.5 lb./ft.	<b>Slurry Weight:</b>	13.7 lb./gal.
<b>Open Hole:</b>	15 1/4"	<b>Slurry Yield:</b>	1.69 ft.3/sk.
<b>Depth:</b>	1500'	<b>Fillup Needed:</b>	1000 ft.
<b>Vol. Factor (Open Hole):</b>	.2927 ft.3/ft.	<b>Cement Needed:</b>	249 Sacks (420 ft.3)
<b>Vol. Factor (In 16" Csg)</b>	.2720 ft.3/ft.	<b>Tail-in System:</b>	Standard, 1% CaCl <sub>2</sub> 1/4 lb./sk. Flake
<b>Annular Volume</b>	426 ft.3	<b>Slurry Weight:</b>	15.6 lb./gal.
<b>W/ 50% Excess Volume:</b>	639 ft.3	<b>Slurry Yield:</b>	1.18 ft.3/sk.
		<b>Fillup Needed:</b>	500 ft.
		<b>Cement Needed:</b>	186 Sacks (219 ft.3)
<b>Well Data:</b>	Intermediate Casing	<b>Lead -in System:</b>	Standard, 6% Gel, 1/8#/sk. Flake
<b>Casing Size:</b>	9 5/8", 40 lb./ft.	<b>Slurry Weight:</b>	13.7 lb./gal.
<b>Open Hole:</b>	12 1/4"	<b>Slurry Yield:</b>	1.69 ft.3/sk.
<b>Depth:</b>	3400'	<b>Fillup Needed:</b>	2900 ft.
<b>Vol. Factor (Open Hole):</b>	.3131 ft.3/ft.	<b>Cement Needed:</b>	708 Sacks (1197 ft.3)
<b>Vol. Factor (13 3/8" Csg)</b>	.3627 ft.3/ft.	<b>Tail-in System:</b>	Standard, 1% CaCl <sub>2</sub> , .5% FLA, 1/8 lb./sk. Flake
<b>Fillup Needed:</b>	3400'	<b>Slurry Weight:</b>	15.6 lb./gal.
<b>Annular Volume</b>	1,139 ft.3	<b>Slurry Yield:</b>	1.18 ft.3/sk.
<b>W/ 25% Excess Volume:</b>	1,424 ft.3	<b>Fillup Needed:</b>	500 ft.
		<b>Cement Needed:</b>	192 Sacks. (227 ft.3)

**FORM 4**  
**ATTACHMENT M**  
**WELL SCHEMATICS**

**FORM 4**

**ATTACHMENT M**

**WELL SCHEMATICS**

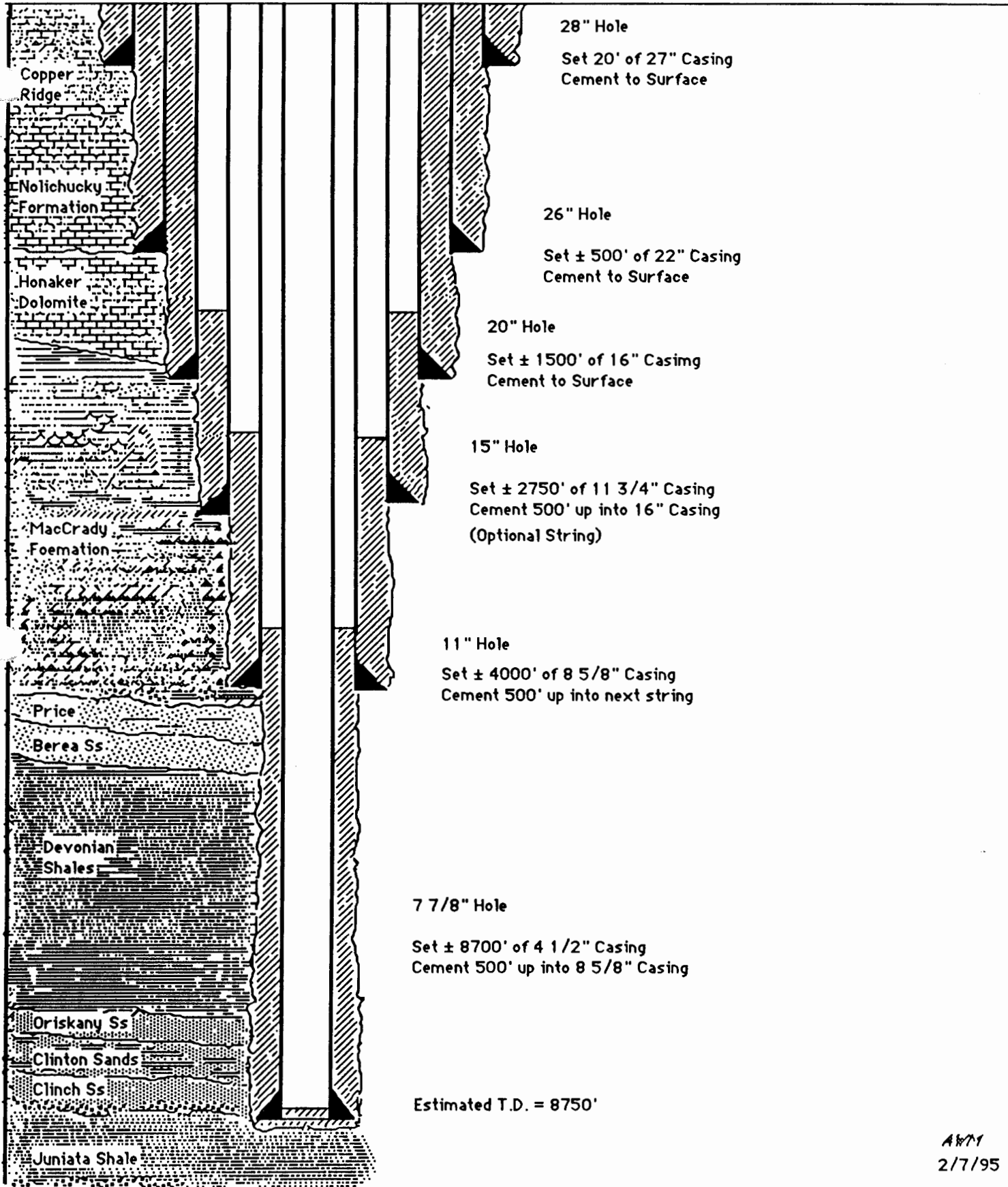
The following schematics are submitted for review:

- A. Typical cavern well casing schematic for the project which would be a Class III - G well.

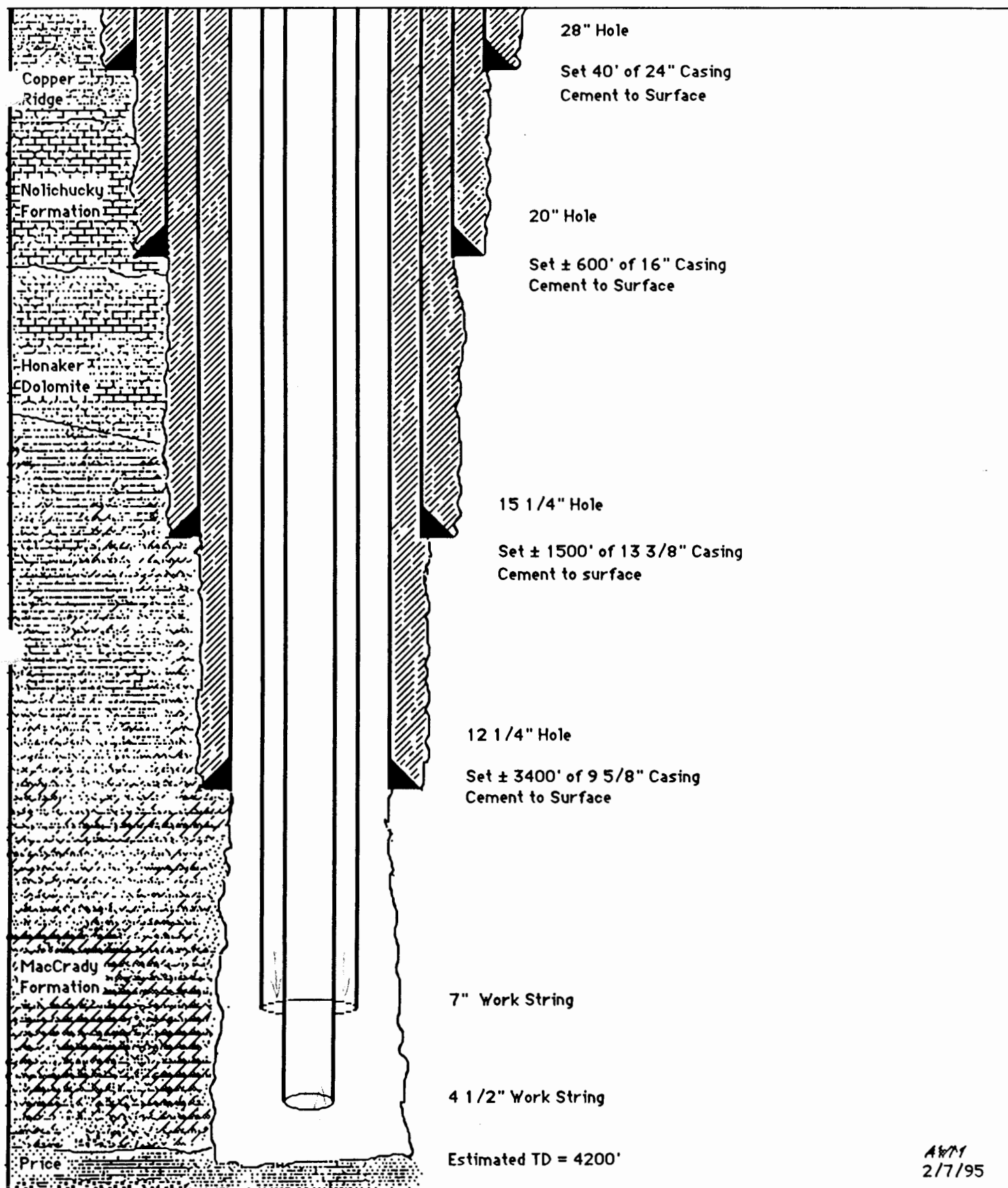
Two working strings are required for cavern development. Raw water will be injected through the 7" string and the resulting brine will be returned to the surface through the 4 1/2" string. The two working strings will be able to move in the hole. This will not only assist in brine return, but will also allow for management of the cavern shape.

- B. Typical disposal well casing schematic for the project which would be a Class 1 -I well.
- C. Typical disposal well schematic with tubing and packer under injection conditions showing subsurface and construction details.

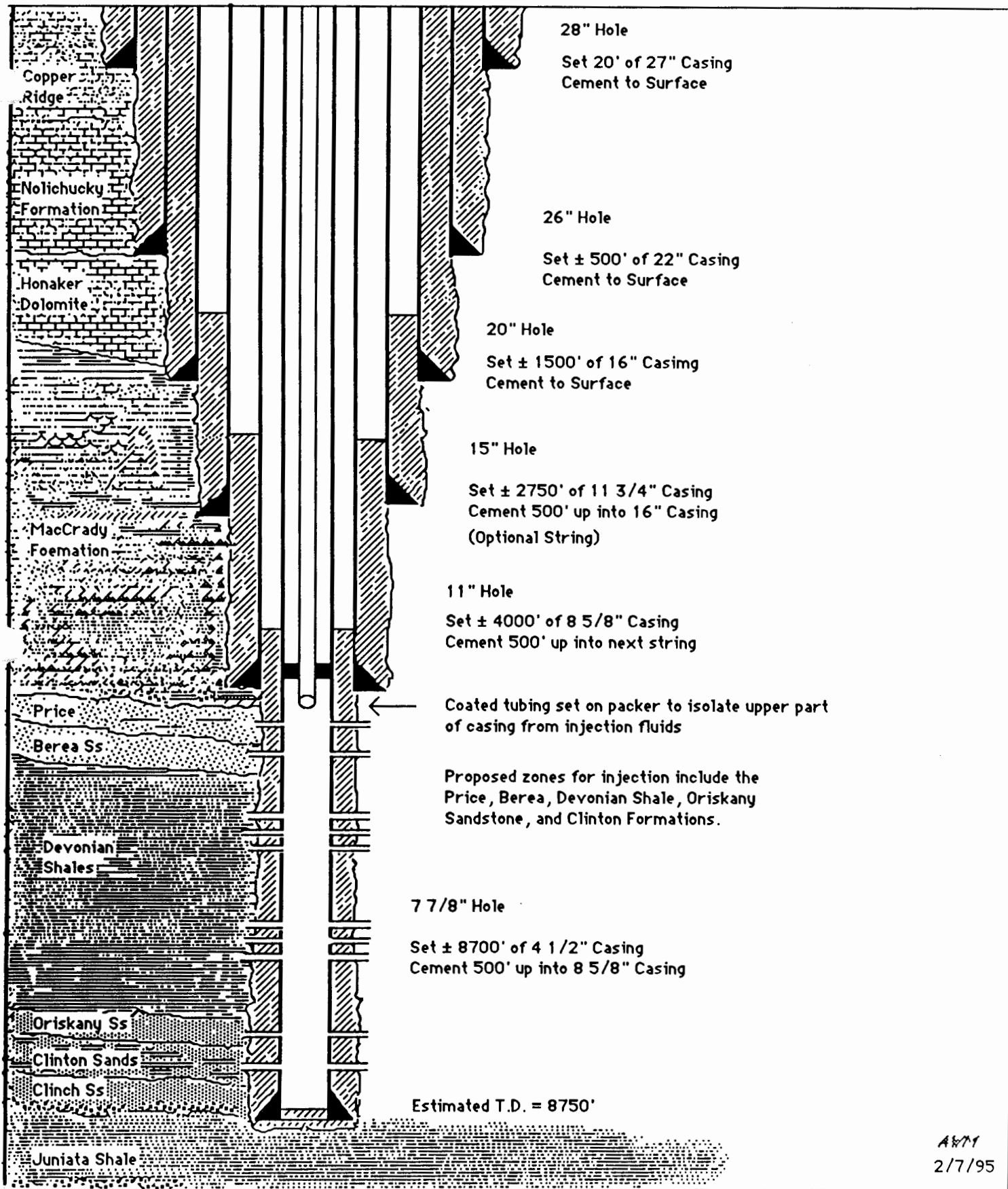
# Typical Class 1-I Disposal Well Casing Schematic



# Typical Class III-G Cavern Well Schematic



# Completed Class 1-I Injection Well with Tubing and Packer



**FORM 4**  
**ATTACHMENT N**  
**INJECTED FLUID DATA**

## **FORM 4**

### **ATTACHMENT N**

#### **INJECTED FLUID DATA; CLASS III - G WELLS**

1. Pressure changes - The process of injecting fresh water into the Class III-G wells will result in the leaching of the formation and the dissolving of salts into the fluid. The resulting specific gravity of the brine will be higher and will vary slightly causing small changes to occur in the circulating pressure.

An analysis of the injected fresh water will be submitted prior to any leaching activity. An analysis of the resulting brine will be submitted once leaching begins and brine fluid becomes available.

2. Changes in direction of movement - No changes in the direction of movement of the injected fluid is expected during the life of the well since all injected fluid will be circulated to surface.

3. Displacement of native fluids in the formation - No free water is known to be present within the MacCrady Formation.

**FORM 4**  
**ATTACHMENT O**  
**WELL FAILURES**

## **FORM 4**

### **ATTACHMENT O**

#### **WELL FAILURES**

Pressure gauges will be positioned at wellheads to measure the annulus pressure between the tubing and the injection casing and the annulus pressure between the injection casing and the intermediate casing. A continuous recording of injection flow rate, pressures, and the cumulative volumes injected will occur. This continuous recording will allow for detection of variances or failures within the well.

The injection wells, cavern wells, and associated facilities will be equipped with fail safe devices that will automatically shut down if high/low injection pressure is encountered. The high pressure shut down and the low pressure shut down settings shall be determined based upon daily injection operating pressures. If a significant pressure change occurs, injection operations will shut down and an investigation to determine the source of the pressure change will begin.

If a leak is discovered in the wellbore equipment, the leak will be repaired as soon as possible. Injection operations will not resume until the wellbore equipment has been pressure tested successfully. If the problem cannot be readily corrected or immediate danger of migration exists, the

pressure in the well would be reduced and stabilized. If the unstable well is a disposal well, any fluid would then be returned to surface tanks for proper disposal at other permitted locations. With the pressure stabilized, the well would be plugged as outlined by Attachment Q.

**FORM 4**  
**ATTACHMENT P**  
**MONITORING PROGRAM**

**FORM 4**  
**ATTACHMENT P**

**MONITORING PROGRAM**

The monitoring program which will be imposed on all wells within the project area will include at least the following:

- \* Level controls on tanks and pump controls (low and high volumes)
- \* Flow metering
- \* Well casing and injection tubing pressure controls (low and high pressures)
- \* Continuous recording at all pressure and flow monitoring points
- \* Continuous monitoring of tubing-casing annulus to determine packer leaks

Virginia Gas Company will demonstrate the mechanical integrity of all wells within the project area according to EPA regulations.

**MONITORING WELLS**

No monitoring wells are proposed or planned in conjunction with this application. However, the casing and tubing pressures will be continuously monitored and recorded, and any problems will be reflected by fluctuations in pressure. If it is determined that a problem exists, corrective action will be implemented immediately.

**FORM 4**  
**ATTACHMENT Q**  
**PLUGGING AND ABANDONMENT**

## **ATTACHMENT Q**

### **PLUGGING AND ABANDONMENT CLASS 1 - I WELLS**

1. Move in service rig and cementing equipment.
2. Release packer, trip out of hole with tubing.
3. Run in hole with tubing to 8700'.
4. Mix and pump 3000 gallons of 6% bentonite gel and 52 sacks of Class A cement and displace tubing.
5. Pull tubing out of hole.
6. Run in hole with cast iron bridge plug; set bridge plug at 3600'; trip out of hole.
7. Run in hole with casing cutters; cut off 4 1/2" casing at top of cement,  $\pm$  3500'; pull 4 1/2" out of hole.
8. Run in hole with tubing to 3600'; mix and pump 3400 gals. of 6% bentonite gel and 36 sacks of Class A cement; displace cement; pull tubing out of hole.
9. Run in hole with casing cutters; cut off 8 5/8" casing at top of cement,  $\pm$  2250'; pull 8 5/8" out of hole.
10. Run in hole with tubing to 2350'; mix and pump 9400 gals. of 6% bentonite gel and 83 sacks of Class A cement; displace cement; pull tubing up to 200'.
11. Mix and pump 109 sacks Class A cement w/ 2%  $\text{CaCl}_2$ ; fill surface; Rig down equipment; reclaim site.

## **PLUGGING AND ABANDONMENT CLASS III - G WELLS\***

1. Move in service rig and cementing equipment.
2. Run in hole with cast iron bridge plug; set bridge plug at 3400'; trip out of hole.
3. Run in hole with tubing to 3400'; mix and pump 5400 gals. of 6% bentonite gel and 72 sacks of Class A cement with 2%  $\text{CaCl}_2$ ; displace cement; pull tubing up to 1500'.
4. Mix and pump 2300 gals. of 6% bentonite gel and 72 sacks of Class A cement with 2%  $\text{CaCl}_2$ ; displace cement; pull tubing up to 600'.
5. Mix and pump 700 gals. of 6% bentonite gel and 72 sacks of Class A cement with 2%  $\text{CaCl}_2$ ; displace cement; pull tubing up to 200'.
6. Mix and pump 72 sacks of Class A cement with 2%  $\text{CaCl}_2$ ; displace cement; pull tubing up out of hole. Rig down equipment; reclaim site.

Note: At this time, all volumes and depths are estimates. Actual volumes and depths may change as field conditions warrant.

\* Natural gas storage will begin once the salt is extracted and the appropriate cavern size is created. At that time, the wells will no longer be under EPA jurisdiction and a request will be made to delete the wells from the area permit.



## PLUGGING AND ABANDONMENT PLAN

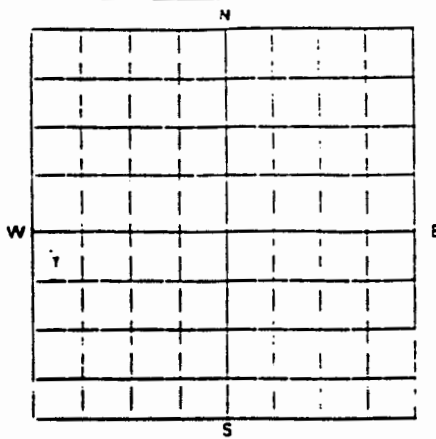
## NAME AND ADDRESS OF FACILITY

Saltville Gas Storage Project  
Washington-Smyth Counties, Virginia

## NAME AND ADDRESS OF OWNER/OPERATOR

Virginia Gas Company  
P.O. Box 2407  
Abingdon, VA 24212

LOCATE WELL AND OUTLINE UNIT ON  
SECTION PLAT — 640 ACRES N/A



STATE

VA

COUNTY

Washington-Smyth

PERMIT NUMBER

N/A

SURFACE LOCATION DESCRIPTION

N/A

1/4 OF

1/4 OF

1/4 SECTION

TOWNSHIP

RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface

Location \_\_\_\_\_ ft. from (N/S) \_\_\_\_\_ Line of quarter section

N/A

and \_\_\_\_\_ ft. from (E/W) \_\_\_\_\_ Line of quarter section

TYPE OF AUTHORIZATION

- ☐ Individual Permit  
☒ Area Permit  
☐ Rule

Number of Wells 3

Lease Name

WELL ACTIVITY

- ☒ CLASS I  
☐ CLASS II  
☐ Brine Disposal  
☐ Enhanced Recovery  
☐ Hydrocarbon Storage  
☐ CLASS III

Well Number

## CASING AND TUBING RECORD AFTER PLUGGING

22"	114.8	±500'	±500'	26"
SIZE	WT(LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
16"	75.0	±1500'	±1500'	20"
11 3/4"	54.0	±2750'	±2750'	15"
8 5/8"	32.0	±4000'	±4000'	11"
4 1/2"	11.6	±8750'	±5250'	7 7/8"

## METHOD OF EMPLACEMENT OF CEMENT PLUGS

- ☒ The Balance Method  
☐ The Dump Bailer Method  
☐ The Two-Plug Method  
☐ Other

## CEMENTING TO PLUG AND ABANDON DATA:

	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inches)	4.0"	4.0"/7.9"	7.9"/10.9"	10.9"			
Distance to Bottom of Tubing or Drill Pipe (ft.)	8700'	3600'	2350'	200'			
Feet of Cement To Be Used (each plug)	52	36	84	109			
Slurry Volume To Be Pumped (cu. ft.)	61	43	99	129			
Calculated Top of Plug (ft.)	8000'	3400'	2150'	0'			
Measured Top of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)	15.6	15.6	15.6	15.6			
Type Cement or Other Material (Class III)	A	A	A	A			

## LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	From	To
UNKNOWN AT THIS TIME			

## Estimated Cost to Plug Wells

\$15,000 per well

## CERTIFICATION

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

NAME AND OFFICIAL TITLE (Please type or print)

SIGNATURE

DATE SIGNED



## PLUGGING AND ABANDONMENT PLAN

## NAME AND ADDRESS OF FACILITY

Saltville Gas Storage Project  
Washington-Smyth Counties, Virginia

## NAME AND ADDRESS OF OWNER/OPERATOR

Virginia Gas Company  
P.O. Box 2407  
Abingdon, VA 24212

LOCATE WELL AND OUTLINE UNIT ON  
SECTION PLAT — 640 ACRES N/A

N									
S									

STATE

COUNTY

VA

Washington-Smyth

PERMIT NUMBER

N/A

SURFACE LOCATION DESCRIPTION N/A

1/4 OF

1/4 OF

1/4 SECTION

TOWNSHIP

RANGE

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface

Location \_\_\_\_\_ ft. from (N/S) \_\_\_\_\_ Line of quarter section

N/A

and \_\_\_\_\_ ft. from (E/W) \_\_\_\_\_ Line of quarter section

## TYPE OF AUTHORIZATION

- ☐ Individual Permit  
☒ Area Permit  
☐ Rule

Number of Wells 3

Lease Name

## WELL ACTIVITY

- ☐ CLASS I  
☐ CLASS II  
☐ Brine Disposal  
☐ Enhanced Recovery  
☐ Hydrocarbon Storage  
☒ CLASS III

Well Number

## CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT(LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
24"		40'	40'	28"
16"	75.0	600'	600'	20"
13 3/8"	54.5	1500'	1500'	15 1/4"
9 5/8"	40.0	3400'	3400'	12 1/4"

## METHOD OF EMPLACEMENT OF CEMENT PLUGS

- ☒ The Balance Method  
☐ The Dump Bailer Method  
☐ The Two-Plug Method  
☐ Other

## CEMENTING TO PLUG AND ABANDON DATA:

	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
of Hole or Pipe in which Plug Will Be Placed (inches)	8.835"	8.835"	8.835"	8.835"			
n to Bottom of Tubing or Drill Pipe (ft.)	3400'	1500'	600'	200'			
s of Cement To Be Used (each plug)	72	72	72	72			
Slurry Volume To Be Pumped (cu. ft.)	85	85	85	85			
Calculated Too of Plug (ft.)	3200'	1300'	400'	0'			
Measured Too of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)	15.6	15.6	15.6	15.6			
Type Cement or Other Material (Class III)	A	A	A	A			

## LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	FROM	To
±3400'	±4200'	Gas Storage Cavern	

## Estimated Cost to Plug Wells

\$15,000 per well

## CERTIFICATION

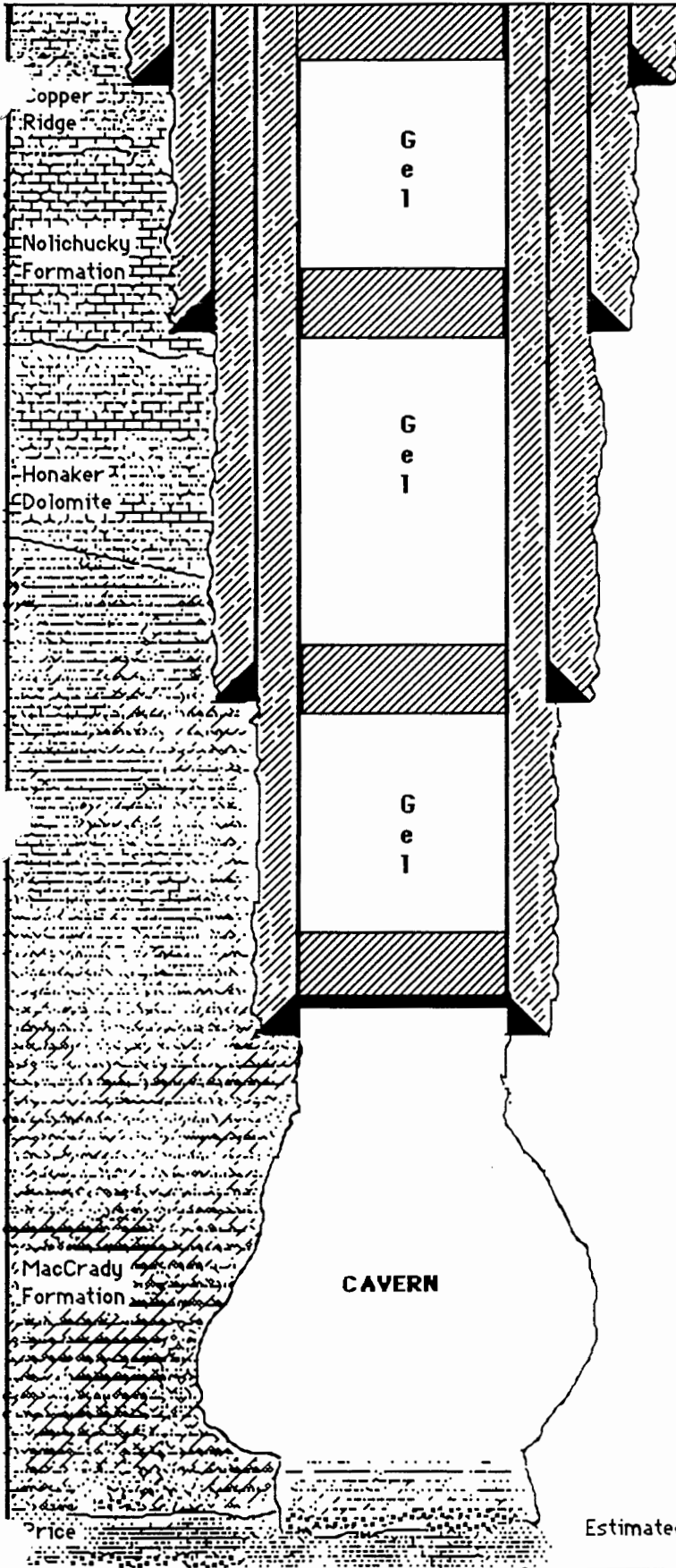
*I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)*

NAME AND OFFICIAL TITLE (Please type or print)

SIGNATURE

DATE SIGNED

# PLUGGING SCHEMATIC FOR CLASS III - G WELLS



## Cement Plug @ 0' - 200'

Set 40' of 24" Casing  
Cement to Surface

Set ± 600' of 16" Casing  
Cement to Surface

## Cement Plug @ 400' - 600'

Set ± 1500' of 13 3/8" Casing  
Cement to surface

## Cement Plug @ 1300' - 1500'

Set ± 3400' of 9 5/8" Casing  
Cement to Surface

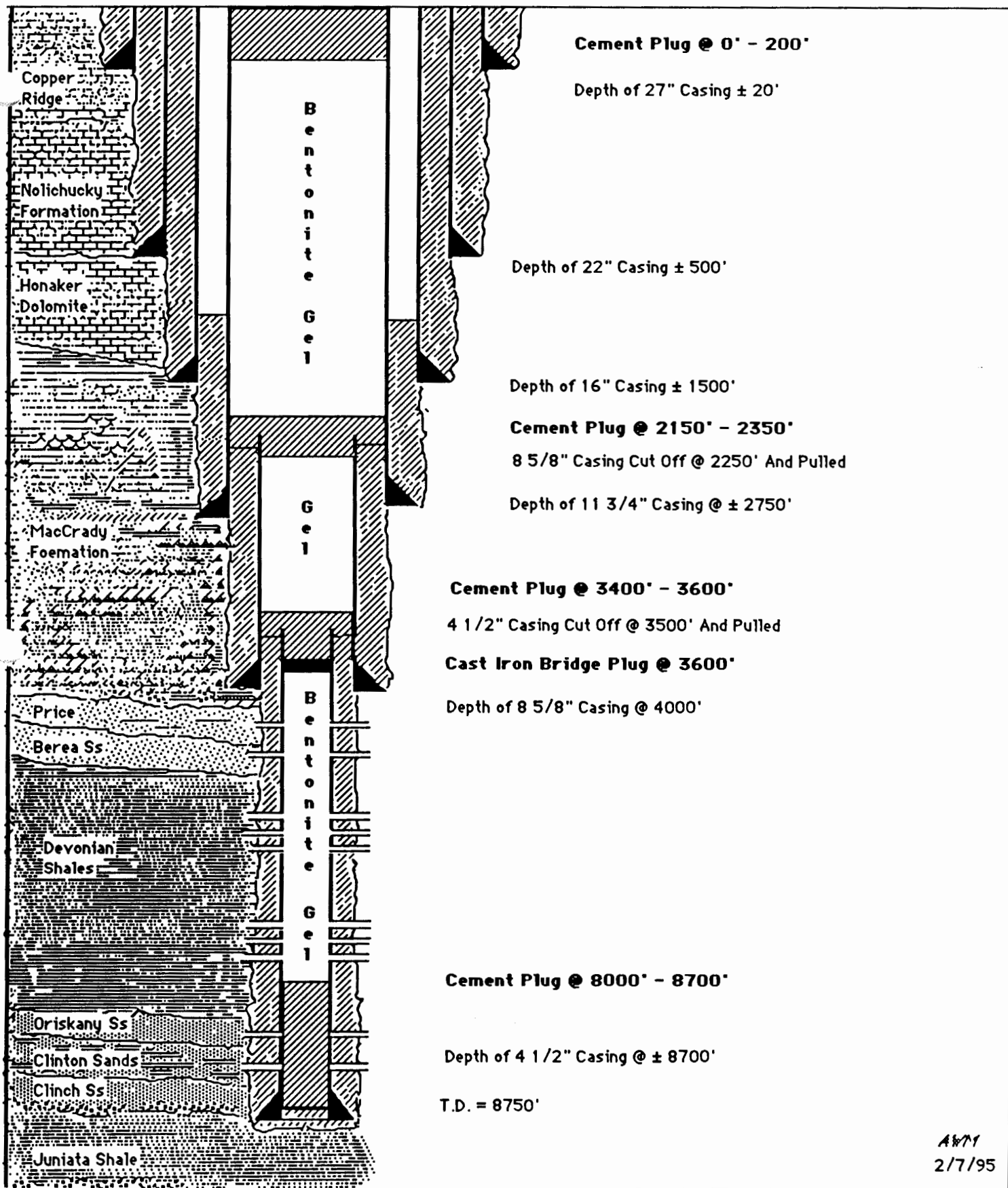
## Cement Plug @ 3200' - 3400'

Cast Iron Bridge Plug Set @ 3400'

Estimated TD = 4200'

AWY  
2/7/95

# PLUGGING SCHEMATIC FOR CLASS 1 - I WELLS



**FORM 4**  
**ATTACHMENT R**  
**NECESSARY RESOURCES**

**FORM 4**  
**ATTACHMENT T**  
**EXISTING EPA PERMITS**

**FORM 4**

**ATTACHMENT T**

**EXISTING EPA PERMITS**

Virginia Gas Company does not possess any existing EPA permits for its operations in the Commonwealth of Virginia.

**FORM 4**  
**ATTACHMENT U**  
**DESCRIPTION OF BUSINESS**

VIRGINIA GAS COMPANY

1994 ANNUAL REPORT

## TO OUR SHAREHOLDERS

VGC's growth accelerated in 1994. The Company sold \$6,880,000 of long term bonds to the public in two issues. The proceeds were used to finance continued expansions of our utility operations in southwest Virginia, especially the Early Grove storage field, where capacity is being increased from 400,000 Dth of working gas to 1,030,000 Dth. VGC signed a 50-50 joint venture agreement for the development of the Saltville storage project with Tenneco Energy Resources Corporation. Our application to extend our distribution service territory to all of Russell and Buchanan Counties was approved by the Virginia State Corporation Commission.

## STATISTICAL SUMMARY

	<u>1994</u>	<u>1993</u>	<u>1992</u>	<u>1991</u>	<u>1990</u>
Total Assets at 12/31	\$15,805,006	\$7,464,978	\$7,491,112	\$4,306,729	\$2,768,932
Total Revenues	\$3,040,691	\$2,251,918	\$1,699,336	\$1,166,305	\$738,798
Net Income (Loss)	\$422,263	\$302,127	\$250,797	\$217,856	\$184,659
Net Worth at 12/31	\$2,792,478	\$2,189,425	\$1,967,318	\$1,116,410	\$648,554
Gas Gathering Throughput (Mcf)	1,815,007	1,673,003	1,029,324	627,553	298,754
Net Gas Production (Mcf)	139,685	133,617	115,868	61,703	21,280
Gas Stored (MMBtu)	520,000	400,000	-0-	-0-	-0-
Wells Drilled	8	1	19	20	17
Gas Wells in Operation at 12/31	87	75	69	45	19
Gas Acreage at 12/31	27,002	46,845	37,415	33,100	8,531
Miles of Gathering Pipeline at 12/31	98.5	84.3	77.6	31.7	10.0
Miles of Distribution Pipeline at 12/31	12.1	11.4	4.3	-0-	-0-
Number of Distribution Customers at 12/31	123	88	2	-0-	-0-
Gas Distribution Sales (Dth)	88,191	63,462	2,549	-0-	-0-
Compression Horsepower at 12/31	1,920	840	840	280	-0-
Number of employees at 12/31	20	16	15	11	9

## OPERATIONAL HIGHLIGHTS

Gas Storage: The Company's VGSC subsidiary invested \$4 million in a major expansion of the Early Grove field. Four new wells were drilled, fifteen existing wells were reworked, most of the pipelines were upgraded to bring them up to U.S. Department of Transportation standards, a new compressor station was built and compression horsepower increased from 280 BHP to 640 BHP, and over 400,000 Mcf of base gas was injected. Storage capacity was approximately doubled, from 400,000 Dth to 800,000 Dth. A major goal of the expansion program is to increase deliverability and to allow the storage inventory to be withdrawn in a shorter period. Roanoke Gas Company renewed their contract for 400,000 Dth for another year, United Cities Gas Company signed a six year contract for 120,000 Dth in 1994 and 180,000 Dth thereafter, and Knoxville Utilities Board signed a letter of intent to store 270,000 Dth in 1995 and 450,000 Dth per year from 1996 to 2003. VGSC filed an application for a certificate of public convenience and necessity with the State Corporation of Virginia in December, 1994 for Early Grove.

The design capacity of the first phase of the Early Grove project is 1,030,000 Dth of working gas storage, with deliverability of 11,000 Dth per day. Total estimated capital cost is \$7.7 million. At year end 1994 \$5.4 million had been invested by VGSC.

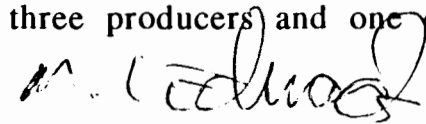
Engineering and geological studies were carried out at the Saltville storage project, and yielded very favorable results. A joint venture agreement was signed in September, 1994 between VGC and Tenneco Energy Resources Corporation (TERC) providing for the development of a high deliverability gas storage facility at Saltville using existing caverns created during salt mining. VGC is the operator and project manager of the Joint Venture, and owns a fifty percent interest with TERC owning the remaining fifty percent. Current plans call for the re-entry of caverns of wells C.H. 16 and C.H. 20 in 1995, evaluation of their storage capacity, construction of surface facilities in 1995 and 1996, and the commencement of service in late summer of 1996. Initial design capacity is for 500,000 Dth of working gas and 50,000 Dth per day withdrawal rate.

Property acquisition began in 1994 for the Grundy storage project. In January, 1994 VGEC purchased six wells and related pipeline facilities from P & S Oil & Gas Corporation, and in September, 1994 reached agreement with Ashland Exploration, Inc. regarding the purchase of the other wells, pipeline and compression facilities that will form the core of the project. If fully developed, the Grundy project could have at least twice the capacity of Early Grove and superior withdrawal characteristics. We expect to have the Grundy storage facility in service by 1998.

Gathering Systems: Total throughput of VGC's gathering facilities increased to 1.82 Bcf in 1994 from 1.67 Bcf in 1993. Capacity of the Haysi Gathering System was increased from 3.5 MMcfd to 5.0 MMcfd by adding 720 BHP of compression horsepower. Work began in late 1994 on an interconnect to hook the Haysi System up with Columbia Gas Transmission Corporation's Conaway gathering system, providing access to additional supplies of gas.

Gas Distribution Operations: In August, 1994 the Virginia State Corporation Commission approved VGDC's application to expand its certificated territory to include all of Russell County and all of Buchanan County. We expect to have substantial growth in distribution sales in these counties over the next few years. The Company received the support of the Boards of Supervisors of Tazewell County and Dickenson County for its efforts to begin studying the feasibility of providing gas service to these counties.

Exploration and Production: VGEC drilled four wells in 1994, compared with one well in 1993. All four were in Dickenson County, Virginia, with three producers and one dry hole.

A handwritten signature in black ink, appearing to read "M. Edwards", is written over the text of the "Exploration and Production" section.

Michael L. Edwards  
President

## **MANAGEMENT PROFILE**

**Michael L. Edwards**, 42, has been President and a Director of Virginia Gas Company since 1987. From 1983 to 1986 he was Executive Vice President and Director of Petroleum Development Corporation. Edwards received an MBA from Stanford Graduate School of Business, and graduated Phi Beta Kappa from the University of California, Berkeley, where he studied geology and physics.

**Frank A. Merendino, Jr.**, 34, is Vice President in charge of operations. He joined VGC in 1990. He was Production Engineer with Equitable Resources Exploration ("EREX") from 1986 to 1990. While with EREX, Mr. Merendino supervised the drilling and completion of over 200 wells in Virginia and eastern Kentucky, including EREX's coalbed methane wells. From 1984 to 1986 he was Petroleum Engineer with Doran & Associates. Frank received a B.S. degree in Petroleum Engineering in 1983 from West Virginia University.

**Karen K. Edwards**, 37, has been Secretary, Treasurer and a Director of Virginia Gas since 1987, and is Vice President in charge of administration, accounting and information systems management. Mrs. Edwards received an MBA degree from the University of Virginia in 1984, and a B.S. in Business Administration from the University of Colorado in 1979. Karen is married to Michael Edwards.

**Mark N. Witt**, 35, Vice President and Director, joined VGC in June, 1994. Prior to that he was Financial Controller - Global Gas for British Petroleum Co., PLC in London, England. He worked in various capacities for BP from 1984 until 1994. From 1980 to 1984 he worked for KPMG Peat Marwick in Houston, Texas. Mr. Witt is a CPA and has a BBA degree in Accounting from the University of Texas.

**James E. Wilson**, 59, is consulting geologist for VGC. He has extensive experience in the Appalachian oil and gas industry, including most recently six years with Equitable Resources Exploration and its Union Drilling affiliate as exploration geologist and geophysicist. Jim worked for 24 years for Consolidated Gas Supply Corporation, the predecessor of Consolidated Natural Gas Company. While with Consolidated he worked on the development of the Greenlick and Leidy gas storage fields, and evaluated the North Summit and Driftwood-Benezette fields for storage conversion. Jim received a B.S. in Geology from Rensselaer Polytechnical Institution.

**Allen W. Mueller**, 39, is General Manager of VGEC and has been with VGC since 1990. From 1988 to 1990 Al was a Virginia State Oil & Gas Inspector. He worked from 1977 to 1988 for Dowell/Schlumberger in

Illinois, Wyoming, Oklahoma, Pennsylvania, West Virginia and Virginia, most recently as Field Service Manager. In that period he cemented and stimulated over 1,000 wells. Mr. Mueller received a B.S. in Geology from Eastern Illinois University.

**Bradley L. Swanson**, 45, is Director of Land for Virginia Gas and has been with the company since December, 1987. He has ten years of oil and gas land experience in Virginia. Brad has a B.A. in Economics from Emory & Henry, served two tours of duty with the United States Marine Corps in South Vietnam from 1966 to 1968, and worked four years as a bank examiner for the Comptroller of the Currency.

**Kenneth W. "Kent" Hales, Jr.**, is General Manager of VGDC and joined the Company in October, 1994. Mr. Hales worked for United Cities Gas Company from 1987 to 1994, most recently as Assistant Manager, and has sixteen years of marketing experience. Kent received a B.S. in Business Management from Carson-Newman College.

## MANAGEMENT'S DISCUSSION AND ANALYSIS OF RESULTS OF OPERATIONS AND FINANCIAL CONDITION

**Results of Operations:** Total revenues and net income both increased over 1993's levels. Revenues rose 35% from 1993's level, while net income was up 40%. Operating expenses were up 18%, from \$1.07 million to \$1.26 million. Over half of this increase in operating expenses was due to the write off of exploration properties in the Bull Creek Prospect. Other expenses increased 44% from \$569,494 to \$818,400, mostly because of higher interest expense. Virginia Gas Company's net income was \$422,263 in 1994, or \$71.26 per share. Total revenues were \$3,040,691. A total of \$107,020 in dividends were paid to shareholders of record as of December 15, 1994, or \$30.00 per share.

VGC has four types of operations: gas storage, gas gathering, exploration and production, and gas distribution. Revenues from the Early Grove Storage Field were \$906,355, or 30% of total Company revenues. This is up from \$625,839 in 1993 (28% of that year's revenues), and \$127,874 in 1992, which represented 7.5% of 1992's total revenues. Of this total for Early Grove, \$79,293 was emergency gas sales, and \$827,062 was storage revenues. The Company also realized \$291,000 in project management revenues from the Saltville Storage Project, bringing total storage revenues to \$1,197,355, or 40% of total corporate sales.

Total gas gathering revenues were \$721,554, or 24% of total company, up from 22% of total company revenues in 1993. Of this total \$617,214 was from VGSC and \$104,340 from VGEC. Gross gathering revenues increased from 26.5¢ per Mcf in 1993 to 39.8¢ in 1994.

Total gas distribution revenues were \$405,408 in 1994, up from \$288,071 in 1993. Our average distribution sales price increased slightly to \$4.60 per Dth from \$4.54 per Dth in 1993. The relative percentage of distribution sales to total sales remained about constant, at 13%.

Most of the company's activities prior to 1992 were concentrated in the exploration and production ("E & P") segment, in which the company organizes and manages the drilling and operation of gas wells in joint ventures with other gas companies and individuals. The relative importance of this business segment has declined in recent years, as the Company's diversification strategy takes effect. Four wells were drilled in 1994 in ventures of this type, one in 1993, nineteen in 1992 and twenty in 1991. The E & P segment accounted for approximately 20% of total revenues in 1994, and 35% of total revenues in 1993, compared with 56% in 1992 and virtually 100% in 1991. Most of this E & P revenue was in the form of charges for services relating to the management of exploration

ventures for third parties.

<u>Segment</u>	<u>1994 Revenues (\$000s)</u>	<u>Percent of Total</u>	<u>1993 Revenues (\$000s)</u>	<u>Percent of Total</u>
Exploration & Production	609	20	793	35
Gas Storage	1,197	40	625	28
Gas Gathering	722	24	495	22
Gas Distribution	405	13	288	13
<u>Other</u>	<u>108</u>	<u>3</u>	<u>51</u>	<u>2</u>
Total	3,041	100%	2,252	100%

### Liquidity and Capital Resources

Cash increased from \$0.8 million at 12/31/93 to \$1.8 million at 12/31/94, as cash flow from operations plus net financing proceeds exceeded net capital investment by \$1.0 million. VGC's current ratio (current assets divided by current liabilities) at 12/31/94 improved to 1.43 from 1.12 at 12/31/93 and from 0.99 at 12/31/92.

Capital expenditures of \$5.9 million were used primarily for: gas storage projects -- \$4.7 million; gas gathering system improvements --\$0.5 million; gas exploration projects -- \$0.4 million, and; purchase of office building and vehicles -- \$0.3 million. The Company's sold \$2.63 million in long term bonds in January, 1994 and \$4.25 million in November, 1994. Proceeds from the issuance of common stock were \$0.275 million.

Long term debt of \$8.7 million made up 65% of the total capital of the company of \$13.3 million (long term debt plus minority interest plus VGC shareholders' equity).

# Virginia Gas Company

## Consolidated Statement of Income

Years Ended December 31, 1994 and 1993

	unaudited 1994	audited 1993
Revenues:		
Operating revenue		
Gas sales	\$ 945,621	\$ 793,431
Pipeline revenues	485,564	443,757
Well operations income	281,102	279,078
Storage revenues	823,700	283,443
Project management revenues	410,853	402,543
	2,946,840	2,202,252
Other income		
Interest income	90,712	40,934
Other income	3,139	8,732
Total revenue	3,040,691	2,251,918
Expenses:		
Operating expenses		
Production expenses	271,242	357,254
Purchased gas expense	387,832	148,869
Operations and maintenance expense	119,138	226,073
Loss on leasehold abandonment	102,961	-
Depreciation, depletion and amortization	382,859	336,113
Total operating expenses	1,264,032	1,068,309
Operating profit	1,776,659	1,183,609
Other expenses:		
General and administrative	594,342	417,604
Other expense	11,352	29,391
Interest expense	212,706	122,499
	818,400	569,494
Income before income taxes	958,259	614,115
Provision for income taxes	331,174	175,043
	627,085	439,072
Minority interest in consolidated subsidiaries (Note 7)	204,822	136,945
Net income	\$ 422,263	\$ 302,127

# Virginia Gas Company

## Consolidated Balance Sheet

December 31, 1994 and 1993

	unaudited 1994	audited 1993
Assets		
Current assets:		
Cash	\$ 1,950,209	\$ 837,459
Accounts Receivable (Note 3)	677,786	313,148
Other current assets	132,418	55,669
Total current assets	2,760,413	1,206,276
Property and equipment (Note 4)	12,776,674	6,853,762
Accumulated Depreciation	(1,014,914)	(634,745)
Net property and equipment	11,761,760	6,219,017
Other assets	1,282,833	39,685
Total assets	\$ 15,805,006	\$ 7,464,978
Liabilities and stockholder's equity		
Current liabilities		
Accounts payable	\$ 960,004	\$ 267,913
Current portion of long term debt (Note 6)	191,937	34,210
Other current liabilities (Note 5)	781,374	566,567
Exploration advances	75,405	211,881
Total current liabilities	2,008,720	1,080,571
Long term debt (Note 6)	8,655,521	1,996,616
Minority interest (Note 7)	1,827,015	1,757,193
Deferred income taxes (Note 9)	593,691	441,173
Total liabilities	13,084,947	5,275,553
Stockholders' equity		
Common stock (no par, 20,000 authorized, 5,926 issued and outstanding) (Note 8)	1,792,741	1,517,741
Retained earnings	927,318	671,684
Total stockholders' equity	2,720,059	2,189,425
Total liabilities and stockholders' equity	\$ 15,805,006	\$ 7,464,978

**Virginia Gas Company**  
**Statement of Changes in Stockholder's Equity**  
**December 31, 1994**

	Common stock	Retained earnings
December 31, 1991	\$ 680,000	\$ 436,410
Issuance of 500 shares under stock option agreements	100,000	-
Issuance of 1,421 shares	710,741	-
Dividends paid	-	(210,630)
Net income	-	250,797
December 31, 1992	1,490,741	476,577
Issuance of 30 shares	27,000	-
Dividends paid	-	(107,020)
Net income	-	302,127
December 31, 1993	1,517,741	671,684
Issuance of 200 shares	200,000	
Issuance of 375 shares under stock option agreements	75,000	
Dividends paid		(166,629)
Net income		422,263
December 31, 1994	\$ 1,792,741	\$ 927,318

**Virginia Gas Company**  
**Consolidated Statement of Cash Flows**  
**December 31, 1994 and 1993**

	unaudited Year Ended December 31, 1994	audited Year Ended December 31, 1993
Cash flow from operating activities:		
Net Income	\$ 422,263	\$ 302,127
Adjustments to reconcile net income to net cash provided by operating activities:		
Depreciation, Depletion and Amortization	380,169	336,113
Loss on Leasehold Abandonment	102,961	-
Deferred income taxes	152,518	100,013
Decrease (increase) in accounts receivable	(364,638)	550,521
Decrease (increase) in other current assets	(76,749)	30,916
Increase (decrease) in accounts payable	692,091	(790,701)
Increase (decrease) in current liabilities	214,807	(112,589)
Increase (decrease) in exploration advances	(136,476)	(940,717)
Net cash provided by operating activities	1,386,946	(524,317)
Cash flows from investing activities:		
Capital Expenditures	(6,032,873)	(2,108,684)
Proceeds from sale of vehicle	7,000	-
Net cash provided (used) by investing activities	(6,025,873)	(2,108,684)
Cash flows from financing activities:		
Payment of loan principal	(542,363)	(205,286)
Proceeds from new loans	7,358,995	1,699,094
Decrease (increase) in other assets	(1,243,148)	(43,727)
Proceeds from issuance of common stock	275,000	27,000
Minority interest investment	69,822	1,945
Dividends paid	(166,629)	(107,020)
Net cash provided by financing activities	5,751,677	1,372,006
Net increase (decrease) in cash	1,112,750	(1,260,995)
Cash at beginning of year	837,459	2,098,454
Cash at end of year	\$ 1,950,209	\$ 837,459
Additional disclosure:		
Interest paid	\$ 412,879	\$ 116,129
Income taxes paid	\$ 65,144	\$ 83,219

**Virginia Gas Company**  
**Notes to the Financial Statements**  
**December 31, 1994**

**Note 1 - Description of Operations**

Virginia Gas Company (the "Corporation") is a privately held Delaware corporation founded in 1987. The Corporation is an integrated natural gas company, with exploration and production, pipeline, storage and distribution operations. Its natural gas operations are located primarily in the southwestern counties of the Commonwealth of Virginia and its main office is located in Abingdon, Virginia.

**Note 2 - Summary of Significant Accounting Policies**

**Principles of Consolidation**

The consolidated financial statements of the Corporation include Virginia Gas Exploration Company ("Exploration," which is wholly owned) and Virginia Gas Storage Company and Virginia Gas Distribution Company ("Storage" and "Distribution," which are 50 percent owned - see Note 7). All significant intercompany transactions and balances have been eliminated in consolidation.

**Revenue Recognition**

Revenue from sales and transportation services are recognized in the same period in which the related gas volumes are delivered to customers or a common carrier. In addition, revenues are recorded for estimated deliveries of gas to these customers from the meter reading date to the end of the accounting period. For wholesale and other commercial and industrial customers, revenues are based on actual deliveries of gas to the end of the period.

**Exploration Advances**

The Company sells participating interests in its gas properties while maintaining a minority ownership interest. Exploration advances represent investor funds received in advance by the Company.

**Property, Plant and Equipment**

The Corporation accounts for its exploration and production operations using the successful efforts method of accounting. Under this method both tangible and intangible costs of drilling and developing producing gas wells and related facilities, including development dry holes, are capitalized and amortized on a unit-of-production basis. Exploratory costs, including exploratory dry holes, annual delay rental and geophysical costs are charged to expense.

Unproved oil and gas properties that are individually significant are periodically assessed for impairment of value, and a loss is recognized at the time of impairment. Capitalized costs of producing gas properties are depreciated and depleted by the unit-of-production method. Support equipment and other property and equipment are depreciated using the straight-line method over their useful lives ranging from 5 to 30 years. On the sale of an entire interest in an unproved property, a gain or loss on the sale is recognized.

**Capitalized Interest**

The Company capitalizes interest (\$181,404 in 1994) on expenditures for significant projects while activities are in progress to bring the assets to their intended use.

**Virginia Gas Company**  
**Notes to the Financial Statements**  
**December 31, 1994**

**Income Taxes**

Income taxes are accounted for using the liability method. Under the liability method, deferred income taxes reflect the impact of temporary differences between the assets and liabilities recognized for financial reporting purposes and amounts recognized for tax purposes.

**Policies Note**

The two subsidiaries in which the Corporation has a 50 percent interest (see Note 7) are not allowed under federal income tax laws to be included in the Corporation's consolidated federal income tax return. As a result, the provision for income taxes has been computed on an separate-company basis with respect to these two subsidiaries. Certain items which have been eliminated for financial reporting purposes are not eliminated for tax return filing purposes. (For state purposes, the provision for income taxes has been determined on a separate-company basis and returns filed on this basis.)

**Note 3 - Accounts Receivable**

	<b>December 31, 1994</b>	<b>December 31, 1993</b>
Joint interest receivables	\$ 78,899	\$ 178,821
Lease operating	154,458	88,745
Trade Receivables	395,023	44,918
Other	49,406	664
	<u>\$ 677,786</u>	<u>\$ 313,148</u>

**Note 4 -Property Plant and Equipment**

	<b>December 31, 1994</b>	<b>December 31, 1993</b>
Pipelines	\$ 4,370,033	\$ 3,337,663
Producing properties	2,166,519	1,359,487
Storage properties	5,341,167	1,227,181
Work in progress	337,949	360,125
Undeveloped proven mineral interests	-	256,307
Vehicles	308,721	221,207
Building and office equipment	252,285	91,792
	<u>\$ 12,776,674</u>	<u>\$ 6,853,762</u>
Less accumulated depreciation, depletion and amortization	<u>(1,014,914)</u>	<u>(634,745)</u>
	<u>\$ 11,761,760</u>	<u>\$ 6,219,017</u>

**Virginia Gas Company**  
**Notes to the Financial Statements**  
**December 31, 1994**

**Note 5 - Other Current Liabilities**

	December 31, 1994	December 31, 1993
Funds held for future distribution	\$ 582,185	\$ 458,644
Deferred revenue	-	64,444
Income taxes payable	199,189	27,699
Other	-	15,780
	<u>\$ 781,374</u>	<u>\$ 566,567</u>

**Note 6 - Long Term Debt**

**Summary of Debt:**

	December 31, 1994	December 31, 1993
Industrial Revenue Bonds:		
Russell County Bonds, effective interest rate of 7.35%, due in varying amounts from 2004 through 2024.	\$ 2,750,000	\$ -
Buchanan County Bonds, effective interest rate 9.006%, due in varying amounts from 1996 through 2017.	4,250,000	-
Unsecured debenture, interest paid annually at prime plus 2%, principal paid in 36 equal installments of \$21,667 beginning September 30, 1995	780,000	780,000
Unsecured subordinated debenture, interest paid monthly at 9.8%, annual principal repayments of \$52,500 through \$217,500 in 1995 through 2000.	780,000	780,000
Mortgage, payable through 2009, interest at 7%	117,637	-
Unsecured Debenture with minority stockholder maturing December 31, 1997, interest paid annually at 8%	40,000	40,000
Unsecured convertible debenture	-	120,000
Unsecured debenture with minority stockholder	-	250,000
Notes payable through 1996 with interest from 7.5% to 13.98% secured by the applicable assets.	129,821	60,826
	<u>8,847,458</u>	<u>2,030,826</u>
Less: Current portion	(191,937)	(34,210)
Long term debt	<u>8,655,521</u>	<u>1,996,616</u>

**Virginia Gas Company**  
**Notes to the Financial Statements**  
**December 31, 1994**

In January of 1994 the Industrial Development Authority of Russell County, Virginia issued its Natural Gas Revenue Bond Series A and B with combined principal of \$3,000,000. The bonds are guaranteed by the general revenues of the Corporation. The proceeds were used to construct a natural gas distribution facility in and around the town of Castlewood, Virginia and for related supporting exploration, production, pipeline and storage facilities. Interest is payable at a rate of 6.5 to 7.5% on a monthly basis beginning February 1994. Principal is payable in conjunction with the Buchanan County Bonds discussed below and range from \$30,000 to \$415,000 per year beginning in 1996.

In November of 1994 the Industrial Development Authority of Buchanan County, Virginia issued its Natural Gas Revenue Bond Series A with principal of \$4,250,000. The bonds are guaranteed by the general revenues of the Corporation and are issued in parity with the Russell County Bonds discussed above. The proceeds will be used to construct a natural gas distribution facility in and around the town of Grundy, Virginia and for related supporting exploration, production, pipeline and storage facilities. Interest is payable at a rate of 6 to 9% on a monthly basis beginning December 1994. Principal is payable in conjunction with the Russell County Bonds discussed above and range from \$30,000 to \$415,000 per year beginning in 1996.

Certain of the Corporations debt agreements contain restrictive covenants which, among other things, require the maintenance of certain financial ratios and provide certain restrictions on dividends. As of December 31, 1994 the Corporation was in compliance with such covenants or has since obtained consent or waivers from the applicable lender.

**Note 7 - Minority Interest**

The Corporation has a 50% ownership in two subsidiaries engaged in the storage, gathering and distribution of natural gas. While the Corporation only maintains 50% ownership, the Corporation has significant control of the operating and financial policies of the subsidiaries. Accordingly, the Corporation has consolidated the subsidiaries as of December 31, 1994 and 1993.

**Virginia Gas Company**  
**Notes to the Financial Statements**  
**December 31, 1994**

**Note 8 - Stock Options and Warrants**

**Stock Options**

The company has granted to certain of its employees and directors compensatory stock options which allow the individual to purchase previously unissued common stock at a fixed price. Options granted approximate the market price as of the grant date. The Company is also obligated to grant options to certain employees upon issuance of additional shares of the Company's common stock to ensure that the employees' share of the Company's outstanding common stock will not be diluted. The Company's obligation is 6% of its common stock as of December 31, 1994, increasing to 7% by December 31, 1995. Of the options outstanding to purchase 1,356 shares at December 31, 1994, 1,237 expire at December 31, 1995.

**Changes in the options outstanding**

	<b>Shares</b>	<b>Options Price Per Share</b>
Outstanding December 31, 1992	1,577	\$200-500
Granted	300	\$500
Outstanding December 31, 1993	1,877	
Granted	129	\$200-900
Exercised	(375)	\$200
Expired	(275)	\$200-500
Outstanding December 31, 1994	1,356	

**Warrant**

On April 1, 1993 the Corporation issued, in conjunction with the issuance of the subordinated debenture described above, a warrant entitling the lender to purchase 744 of the common shares of the Corporation at \$666 per share. The warrant is exercisable upon the earlier of: repayment of the debenture; the entering into a contract for the sale of all or substantially all of the assets of the Corporation or any of its subsidiaries; a bona fide offer being made by any person for, or the sale in one or more related transactions of, more than 10% of the Corporation's then outstanding common stock or 10% of any of its subsidiaries' then outstanding common stock; February 28, 1998; the effective date of the first registration statement filed by the Corporation covering an underwritten offering of any of its securities to the general public; and the occurrence of an event default under the terms of the financing agreement. The warrant expires on February 28, 2003.

Concurrent with the issuance of the warrant, the Corporation has issued to the lender options enabling the lender to purchase common shares sufficient to maintain 14 percent of the ownership of the Company on a fully diluted basis. The options granted the lender the right to purchase the common shares at 66 percent of the issue price of any proposed common stock offerings and become exercisable subject to the terms described in the preceding paragraph. The options expire February 28, 2003.

**Virginia Gas Company**  
**Notes to the Financial Statements**  
**December 31, 1994**

**Note 9 - Income Taxes**

The components of the provision for income taxes are as follows:

	<b>December 31, 1994</b>	<b>December 31, 1993</b>
Current:		
Federal	\$ 205,776	\$ 72,332
State	32,622	2,698
	<u>238,398</u>	<u>75,030</u>
Deferred:		
Federal	62,539	64,315
State	30,237	35,698
	<u>92,776</u>	<u>100,013</u>
	<u>\$ 331,174</u>	<u>\$ 175,043</u>

The significant components of deferred tax assets and liabilities are as follows:

	<b>December 31, 1994</b>	<b>December 31, 1993</b>
Deferred tax assets:		
Net operating loss carry forward	\$ (117,459)	\$ 128,528
Alternative minimum tax credit carryforwards	(205,843)	100,715
Other	(23,579)	28,340
Total	<u>\$ (346,881)</u>	<u>\$ 257,583</u>
Deferred tax liabilities:		
Capital assets	<u>\$ 994,324</u>	<u>\$ 698,756</u>

**Virginia Gas Company**  
**Notes to the Financial Statements**  
**December 31, 1994**

A reconciliation of the tax provision at the statutory federal income tax rate and the Company's actual provision for income tax is as follows:

	December 31, 1994	December 31, 1993
Tax at statutory rate	\$ 325,808	\$ 208,799
State income taxes, less federal benefit	41,524	\$ 25,342
Statutory depletion in excess of cost depletion	(8,500)	(32,381)
Other, net	(27,658)	(26,717)
	<u>\$ 331,174</u>	<u>\$ 175,043</u>

Distribution has net operating loss carryforwards at December 31, 1994, as follows:

Amount	Expires
\$ 240,405	2008
105,063	2009
<u>345,468</u>	